ISSN: 2667-6125

# JOMAES

# JOURNAL OF MANAGEMENT AND ECONOMIC STUDIES

Volume 4
Issue 1
Year 2022

www.jomaes.org

JOMAES JOURNAL OF MANAGEMENT AND ECONOMIC STUDIES

**2022, Vol.4, Issue.1**

JOMAES JOURNAL OF MANAGEMENT AND ECONOMIC STUDIES

**2022, Vol.4, Issue.1**

# Indexing

DRJI | Directory of Research Journals Indexing

ReseachBib – Academic Resource Index

ISI | International Scientific Indexing

RI-ROOTINDEXING

ESJI | Eurasian Scientific Journal Index

ICI Index Copernicus

General Impact Factor

JOMAES JOURNAL OF MANAGEMENT AND ECONOMIC STUDIES

# Contents

2022, Vol.4, Issue.1

JOMAES

Journal of Management and Economic Studies

2022, 4(1): 1-14 DOI: 10.26677/TR1010.2022.955

Journal Homepage: https://www.jomaes.org


# Apparel Supply Chain Optimization Focusing On Right Supplier Selection

**Shibbir AHMAD**
Dhaka University of Engineering & Technology, Mechanical Engineering, Bangladesh.
www.orcid.org/0000-0003-4976-6755
ahmadjerin@gmail.com

**Mohammad KAMRUZZAMAN**
Dhaka University of Engineering & Technology, Mechanical Engineering, Bangladesh.
kamruzzamn2002bd@yahoo.com

**Abstract**

The apparel manufacturing organization has been suffering from delivery issues due to the unavailability of materials in a timely manner. In this paper, the analysis has been focused on the selection criteria of the suppliers to find the right supplier to place the material's orders to get it on time and optimize the supply chain. Furthermore, it has seen the delay delivery status of the conventionally selected suppliers in the disaster situation. Meanwhile, the results have been found after the placement of the orders to the right suppliers to get the best outcome. 20% efficiency has been intensified because of the timely inhoused of the materials, which helps to reduce the productivity gap and the smooth supply chain can be maintained due to the right supplier's selection by the analysis through cost ratio analysis method and dimensional analysis method. Moreover, the profit-loss analysis has shown the consequences of the erroneous supplier's assortment.

**Keywords**: Cost minimizing, Apparel Supply Chain, Quality, On-time delivery, Higher Efficiency.

## 1. INTRODUCTION

Higher Efficiency depends on a smooth supply chain. As raw materials of the apparel manufacturing industry purchase from overseas, so it is an obligatory factor to optimize the supply chain in the garment manufacturing organization to maximize the profit. However, it has been observed that the majority of the garment manufacturers agony for receiving materials in a timely manner. The giant reason behind that is traditional the selection of suppliers without evaluation of the supplier's performance. Consequently, factories are being suffered to maintain

the delivery dates. In this context, the selection of the right suppliers is a vital task for the apparel manufacturing organization to retain in the competitive market. Apparel manufacturing industry have been trying to update like green supply chain concept has introduced to implement in the apparel industry (Akhter et al,2020).

The merchandising team of the apparel manufacturing industry places the orders of the raw materials to the suppliers by picking the number or email or via any known person without having realistic information regarding quality, delivery, and other important criteria. The scientific analysis of the supplier's selection methods can implement to select the right suppliers in real time in apparel manufacturing organization. Supply chain management has a significant impact on product and service quality, emphasizing the relevance of the interaction between procurement, external suppliers, and quality (Bal.M et al.,2013). Appropriate supplier selection in today's modern supply chain is a strategic challenge for the company. The total business of the corporation is a crucial strategic aspect. The significance of this is that at the start of the last decade of the previous century, adequate supplier selection was recognized (Liao C.N et al.,2011). Some researchers emphasized that the inability of providers to meet their delivery commitments and expectations regarding delivery is one of the supply chain's three key sources of uncertainty (Davis.T,1993). Because of the vital role of suppliers in supply chain management, supplier selection is a crucial procurement operation. The providers' features in terms of pricing, quality, delivery, and service in achieving the objectives of the supply chain (Kagnicioglu, C. H. ,2006). The measures characterized by Dickson and later altered by Weber are still generally acknowledged in various investigations; in any case, the climate and significance of specific measure changes affirm the work in which the creators incorporate over 110 works that were examined on the issue of providers' choice (Cheraghi, S. H et al.,2011). Later, this led to an overview among an enormous number of supervisors to inspect how they arrive at a compromise while choosing suppliers (Verma, R et al.,1998 ). Their exploration showed that supervisors place the highest priority on quality as the main property of providers, trailed by conveyance and cost. Research on the effect of measures in the production network proceeds toward the start of this century, and perceived dependability of conveyance as a rule of choice (Krause, D. R et al.,2001), while some others in their review notice the need to add development as another equivalent rule ( Karpak, B,2001).

According to some researchers in 2001, before starting with defining the most important criteria by which it is necessary to assess the suppliers, you must first define an approach that involves the relationship between the customer and supplier (Birch, D. ,2001). Therefore, procurement managers must first make certain agreements with suppliers and determine the conditions for negotiations. According to the same author, the criteria for suppliers' selection can be classified into five different categories: cost, logistics, quality, development, and management; while in their study, they used four criteria for evaluating suppliers: price, quality, technology, and service (Bhutta, K. S et al.,2002). Later on, in a study, it processed similar criteria as was the case in (Çebi, F et al.,2003). One of the core hindrances to the smooth supply chain is the purchase of materials from overseas for the Bangladeshi apparel manufacturing industry. Orthodoxly, it takes 60 days for materials to arrive from a peregrine country like China to Bangladesh, and the factory gets less than 30 days to manufacture and ship the products to the cessation customers. Meanwhile,

selecting the right supplier at the right time is the key factor to making a smooth supply chain and achieving optimized chain performance. Hence, the paramountcy of supply chain optimization through precise supplier choosing to garment factories in our territory is essential. Deployment of artificial perspicacity in supplier selection can ameliorate the method of activity-predicated costing (Roodhoft et al., 1996).

Furthermore, many mathematical expressions implement to optimize the supply chain, however, when such a mathematical expression cannot be obtained, there is a need to utilize an estimation technique to commence the solution procedure. The estimated gradient direction guides the search process to peregrinate from one potential solution to another in an iterative scheme in a process called stochastic approximation (Robbins et al., 1951).Supplier selection incorporates a variety of implements, including cluster analysis, statistical methods, data development, analysis, case-based reasoning systems, decision support systems, total cost of ownership models, mathematical programming, and so on (De Boer et al., 2001)(Taluri S., 2002)(Choy et al., 2003)(Zhu. J., 2004). The special concentration on the ANN exercise set has to be given to avoid overfitting approximations that directly affect the predictive precision resulting from ANN. (Alam et al. 2004) suggest that the design of experiments (DOE) can be cumulated with ANN to surmount the overfitting quandary. Several simulation techniques are accordingly implemented to assess the variety of configurations of the system to be optimized. In the Operation Research (OR) literature, this type of optimization is referred to as "simulation optimization" (Tekin et al., 2004).On the other hand, another method used to optimize the stochastic objective functions is called direct search method, since the dubiousness is treated directly by optimizing stochastic functions (Tezri et al., 2004).

Supply chain optimization is an ascendant, pragmatic implement that can amplify the performance now and hold the position of the supply chain for the future. Although simulation is one of the most prosperous ways of analyzing supply chain processes (Beyer et al., 2007), furthermore, Artificial Neural Networks (ANNs) are another efficacious method to estimate arbitrary smooth functions and can be fine-tuned by utilizing stochastic replication values (Haykin's, 2008).In today's ecumenical and competitive environment, SCM and decision-making processes arise both from strategic and operational standpoints (Papageorgiou, 2009).Several review papers have been published in the last two decades that address miscellaneous aspects of SCs, e.g., SC management (Croom et al. (2000), green aspects of SCs (Srivasta 2007), ecumenical SC models and design (Meixell and Gargeya 2005), and multi-objective optimization (Trisna et al. 2016).It is generally acknowledged that one of the main obligations within the buying capacity of a business is the assessment and determination of providers. Moreover, it is well-founded that choices for buying can be scrambled and are regularly found on various measures (Cousins, Lawson, and Assistant, 2006; Pohl and Förstl, 2011). There are so many methods to analyze the selection procedure, however, we will implement the cost ratio analysis method and dimensional analysis method to identify the right suppliers for the manufacturing unit. In addition to this, we have collected data from two production units to analyze the consequences for the traditional supplier's selection process.

*1.1. Traditional Supplier Selection Strategy and its impact on apparel supply chains*:

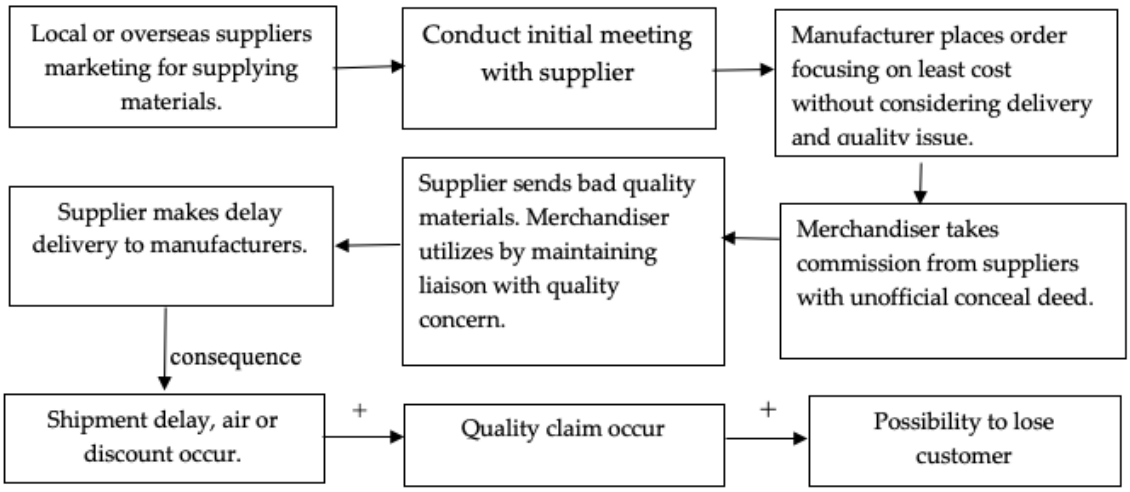



**Figure 1**: Traditional Suppliers' Selection Strategy

The supply chain (SC) department selects the suppliers based on the traditional method. Initially, the SC department is introduced to the materials supplier through friends or familiar people. On the other hand, if the suppliers find the responsible person's contact number or email for any company, they send an email to the manufacturers with prior knowledge of the factory's strength to the suppliers. There is an opening discussion about whether the suppliers are able to make the required items. If a manufacturing company sees that the unit price is reasonable, order will eagerly place with these designated suppliers without conducting any evaluation process based on supplier evaluation criteria. In this case, the purchaser takes a commission from those suppliers. Both parties agreed with the unofficial hidden dead to stay in a win-win situation, hence there is a gigantic possibility of getting bad quality products as well as nonprofessional delivery. In most cases, the merchandiser motivates the inspection quality controller (IQC) to approve this item, and consequently, the IQC takes advantage from the merchant end. Once the materials are received with bad quality, they do the production and ship the goods. In addition, the materials are received after 15 to 40 days of the actual delivery date. As a result, goods are shipped by air, or at a reduced rate. In this context, owners cannot do anything as they are dependent on merchandisers, and openly, they misunderstand the owner by stating this is a nominated supplier from the buyer's end or the suppliers for these specific items are rare in the world. The traditional supplier selection process is nothing but a vicious cycle that must be ruined in the factory professional environment which has shown in figure 1.

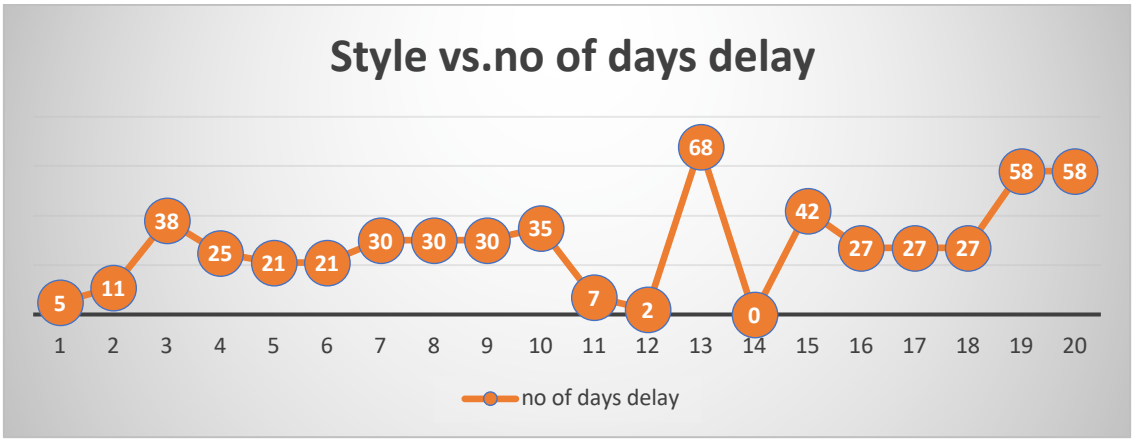



**Figure 2**: PO vs. Delay Status (PU-1)

From figure 2, the supplier is supplied materials after the minimum zero days to a maximum of sixty-eight days after the actual delivery date. This is an absurd delivery status. For such delays, the goods must be shipped by air, even if buyers cancel their orders, resulting in a massive loss for the manufacturing unit.

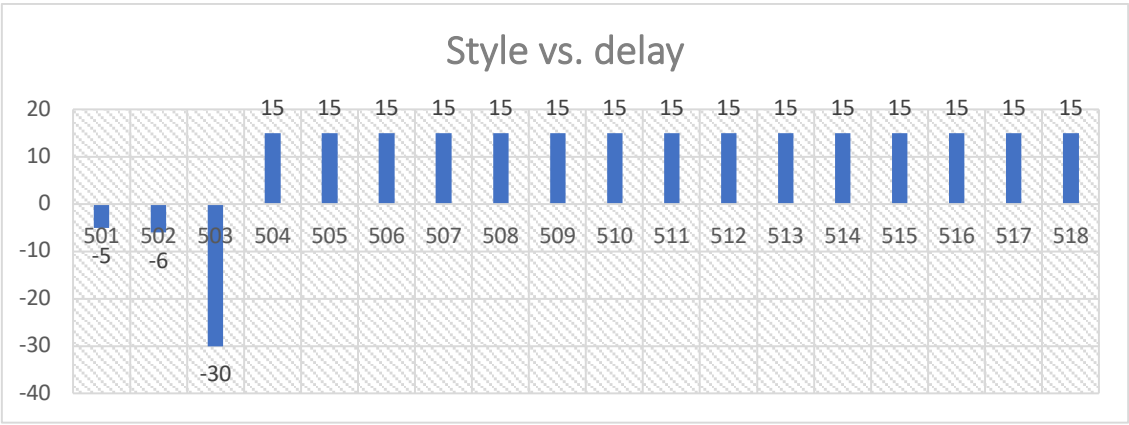



**Figure 3:** PO vs. Delay Status (PU-2)

Similarly, another manufacturing unit is suffered from delayed delivery of raw materials. It is found from figure 3 that two weeks are delayed for each purchase order. Subsequently, manufacturers have to pay more for air shipment and discount purposes. It is happened due to selecting the suppliers without any evaluation prior to the order placement. Customers are thus dissatisfied with placing orders to the same location in the long run. The business is in the risk zone. Many factories had to shut down since they were unable to pay workers' salaries on time due to delayed shipments and their related consequences.

**Table 1:** Factory Wise Income vs. Profit Loss

| Factory | Order quantity | price | Income | Production cost | Air cost | Discount | Total cost | Profit/loss |
|---|---|---|---|---|---|---|---|---|
| PU1 | 500000 | $ 0.16 | $ 80,000.00 | $95,000 | | $15,000 | $110,000 | $ (30,000.00) |
| PU2 | 350000 | $ 0.25 | $ 87,500.00 | $70,840 | $20,000 | | $90,840 | $ (3,340.00) |

After the analysis, the consequences are discussed in Table 1 for the manufacturing units 1 and 2. For instance, a customer placed five hundred-thousand-piece orders with the manufacturing unit 1. The unit price for those garments is $0.16. Hence, the income is $80000 from whole orders, whereas the production cost is $95000, which is higher than the income as additional machines is used to do quick delivery since the materials are twenty days delayed from the actual delivery. Finally, the shipment is made two weeks later than the actual delivery date. That is why the buyer has imposed an 18.75% discount on the orders. The company is paid a discount of $20,000.00. The total cost incurred to ship the goods is $110.000, which is $30000 more supplementary than income. On the other hand, production unit 2 is taken 350000 orders whose unit price is $0.25. However, it is seen that the manufacturing cost is $70,840. The goods are delivered by air. Hence, an additional $2000 is added to the total cost, and it is come to $90,840, but the actual income from those orders was $87,500.00. The ultimate results are $3,340 lost and is paid from the manufacturer's pocket merely because of the materials' acknowledged delay.

## 2. METHODS

### *2.1. Cost Ratio Analysis Method*:

In this research, the application of the cost ratio analysis method to select the right supplier based on cost, focusing on quality, delivery, and service, is the basis of this research. Table 2 shows the cost analysis of the ten suppliers for the same items. The analysis has been done by using equation 1. For example, the total penalty for the supplier A is 3%. The quoted price per unit for this item is $1.10. From equation 1, we have got a net adjusted cost of $1.10 (1+3%) = $1.13. Likewise, the rest of the suppliers' costs have been analyzed and found to be suppliers D, I, and J, selected as the best suppliers as the production unit needs three suppliers for the required items.

$$\text{Net Adjusted cost} = \text{Quoted price/unit } (1+ \text{ total penalty}) \qquad (1)$$

**Table 2**: Implementation of Cost Ratio Analysis Method to Select The Right Suppliers For PU-1

| Supplier | Quality cost ratio | Delivery cost ratio | Service cost | Total Penalty | Quoted price/unit ($) | Net Adjusted cost |
|---|---|---|---|---|---|---|
| A | 1% | 1% | 1% | 3% | $1.10 | $1.13 |
| B | 2% | 2% | 3% | 7% | $1 | $1.07 |
| C | 3% | 1% | 4% | 8% | $1 | $1.08 |
| D | 2% | 2% | 1% | 5% | $1 | **$1.05** |
| E | 1% | 1% | 1% | 3% | $1.12 | $1.46 |
| F | 2% | 1% | 1% | 4% | $1.05 | $1.09 |
| G | 3% | 2% | 2% | 7% | $1 | $1.07 |
| H | 1% | 2% | 1% | 4% | $1.03 | $1.07 |
| I | 2% | 1% | 1% | 4% | $1.02 | **$1.06** |
| J | 2% | 2% | 2% | 6% | $0.90 | **$0.95** |

At the same time, Table 3 portrays the suppliers' selection scenario for production unit 2. It is showed that suppliers D, F, and J are selected as the right suppliers to place the orders. In this way, the right suppliers can be selected for the manufacturing unit.

**Table 3:** Implementation of Cost Ratio Method to Select The Right Suppliers For PU-2

| Supplier | Quality cost ratio | Delivery cost ratio | Service cost | Total Penalty | Quoted price/unit ($) | Net Adjusted cost |
|---|---|---|---|---|---|---|
| A | 2% | 1% | 1% | 4% | $1.05 | $1.09 |
| B | 1% | 1% | 1% | 3% | $1.20 | $1.24 |
| C | 2% | 2% | 2% | 6% | $1.05 | $1.11 |
| D | 2% | 2% | 1% | 5% | $1 | **$1.05** |
| E | 1% | 2% | 2% | 5% | $1.15 | $1.21 |
| F | 2% | 1% | 2% | 5% | $1.02 | **$1.07** |
| G | 3% | 1% | 2% | 6% | $1 | $1.17 |
| H | 2% | 2% | 1% | 5% | $1.07 | $1.12 |
| I | 2% | 2% | 2% | 6% | $1.05 | $1.11 |
| J | 2% | 3% | 2% | 7% | $0.95 | **$1.02** |

*2.2. Dimensional Analysis Method***:**

In this paper, the dimensional analysis method is applied to pick the right supplier in real time for the apparel manufacturing industry to optimize the supply chain.

$$VPI = \sqrt[w]{\prod_{i=1}^{n} \left(\frac{X_i}{Y_i}\right)^{w_i}} \qquad (2)$$

Here,

VPI=Vendor Parameter Index
Xi= Performance Criteria Score for Supplier
Yi=Standard Performance Criterion (i=1,2,3,……...nth)
Wi=Weight (Relative Importance) Assigned to Criterion

$$w = \sum_{i=1}^{n} |w_i|$$

In this research, the supplier selection process is analyzed using equation 2. Table 4 shows that the VPI scores for suppliers A, B, and E are higher than any other for production unit 1. Hence, these three suppliers can be selected as the right suppliers. The demo calculation is given below for understanding the selection methodology using the dimensional analysis method.

$VPI(A) = \sqrt[14]{(0.98/1.00)^{6}.(29/27)^{-5}.(3/2)^{-3}}$

$=7.13$

Similarly, the VPI scores of suppliers A and B are higher than the others. Thus, these two suppliers is selected as the best ones, which is depicted in Table 5 for manufacturing unit 2. The analysis is done for five suppliers who are supplying the same materials. By studying the selection criteria, the decision can be taken from such an analysis as to which one would be the best and right supplier.

**Table 4:** Implementation of Dimensional Analysis Method to Select The Right Suppliers For PU-1

| | Quality (%) | Delivery (days) | Cost ($) | VPI |
|---|---|---|---|---|
| Weights | 6 | -5 | -3 | |
| Supplier A | 98 | 29 | 3 | 7.13 |
| Standard | 100 | 27 | 2 | |
| Weights | 5 | -2 | -3 | |
| Supplier B | 80 | 33 | 3 | 5.36 |
| Standard | 100 | 27 | 2 | |
| Weights | 4 | -5 | -5 | |
| Supplier C | 70 | 35 | 3 | 1.25 |
| Standard | 100 | 27 | 2 | |
| Weights | 3 | -6 | -5 | |
| Supplier D | 60 | 31 | 3 | 1.53 |
| Standard | 100 | 27 | 2 | |
| Weights | 8 | -3 | -2 | |
| Supplier E | 99 | 28 | 3 | 8.51 |
| Standard | 100 | 27 | 2 | |

**Table 5:** Implementation of Cost Ratio Method to Select The Right Suppliers For PU-2

| | Quality (%) | Delivery (days) | Cost($) | VPI |
|---|---|---|---|---|
| Weights | 5 | -6 | -5 | |
| Supplier A | 95 | 21 | 3 | 9.49 |
| Standard | 100 | 27 | 2 | |
| | Quality(%) | Delivery (days) | Cost($) | |
| Weights | 2 | -5 | -5 | |
| Supplier B | 85 | 23 | 3 | 6.41 |
| Standard | 100 | 27 | 2 | |
| | Quality(%) | Delivery (days) | Cost($) | |
| Weights | 4 | -2 | -5 | |
| Supplier C | 78 | 25 | 3 | 3.31 |
| Standard | 100 | 27 | 2 | |
| | Quality(%) | Delivery (days) | Cost($) | |
| Weights | 3 | -4 | -5 | |
| Supplier D | 75 | 38 | 3 | 1.59 |
| Standard | 100 | 27 | 2 | |
| | Quality(%) | Delivery (days) | Cost($) | |
| Weights | 8 | -3 | -5 | |
| Supplier E | 65 | 35 | 3 | 0.07 |
| Standard | 100 | 27 | 2 | |

## 3. RESULTS

In addition, it is also detected from Figures 4 and 5 that the benefit-to-cost (BR) ratio intensified. BCR is shown 1.10 on average from figure 4 while materials are taken from traditionally selected suppliers, and the significance of the delay in delivery of the materials to the production unit is clear. However, the BCR is increased by 42%, which portrayed in figure 5.

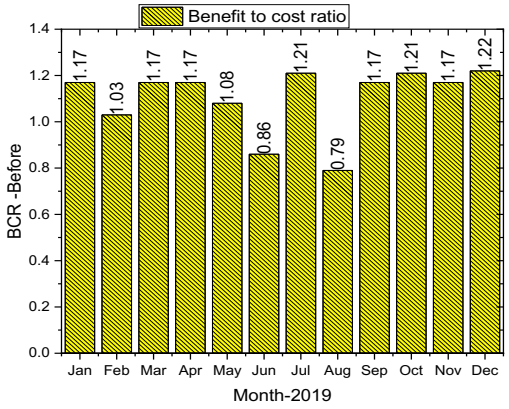



**Figure 4**: Benefit -to-Cost Ratio Analysis -Before (PU-1)

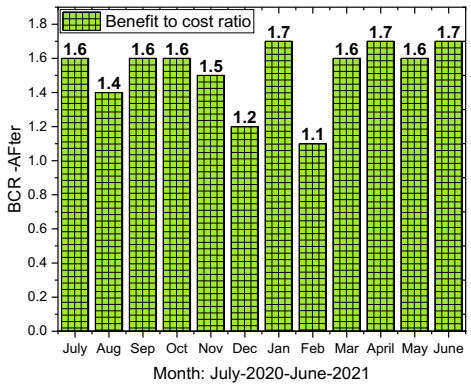



**Figure 5**: Benefit to Cost Ratio Analysis -After (PU-1)

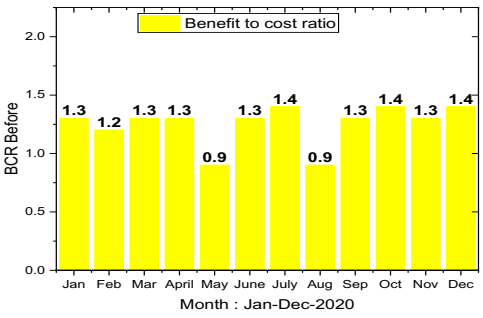



**Figure 6:** Benefit -to-Cost Ratio Analysis -Before (PU-2)

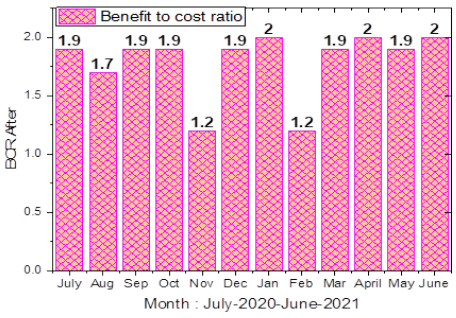



**Figure 7:** Benefit -to-Cost Ratio Analysis -Before (PU-2)

Similarly, the BCR ratio is augmented from 0.9 to 2.0 which has shown in figure 6 and 7 respectively where the improvement over the earlier BCR because of the best supplier selection for purchasing the raw materials from the right suppliers, which leads to an optimized supply chain. After the selection process through cost ratio analysis and the dimensional analysis method, manufacturing units 1 and 2 are placed material orders to the best selected suppliers. It is seen from figure 8 that the materials receiving status improved to 94% to 96% and 94% to 97% once the right supplier's selection.

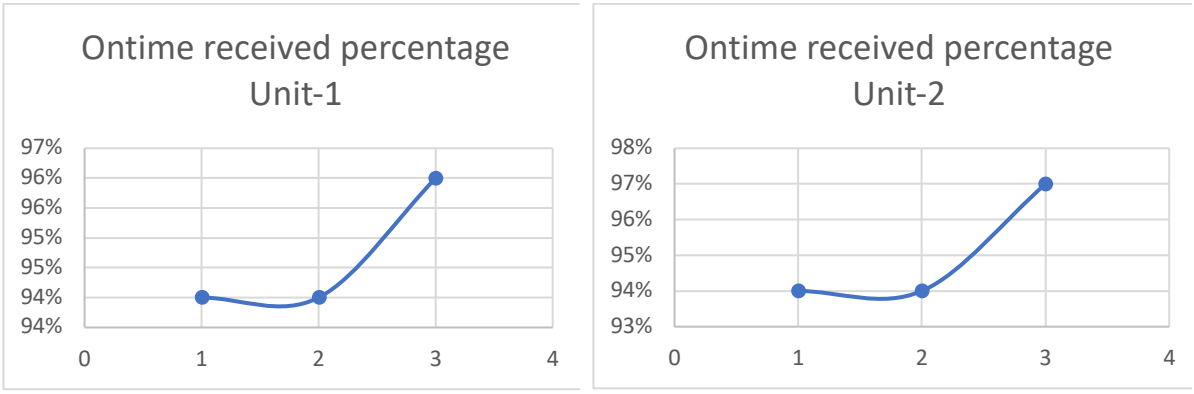



**Figure 8**: Ontime Materials Received Status

The right supplier's selection is the core task for any apparel manufacturing to keep the supply chain smooth and get the optimal results from the chain as a whole. That's why the research is emphasized on hunting for the right supplier's selection based on the criteria, i.e., quality, delivery, and least cost.

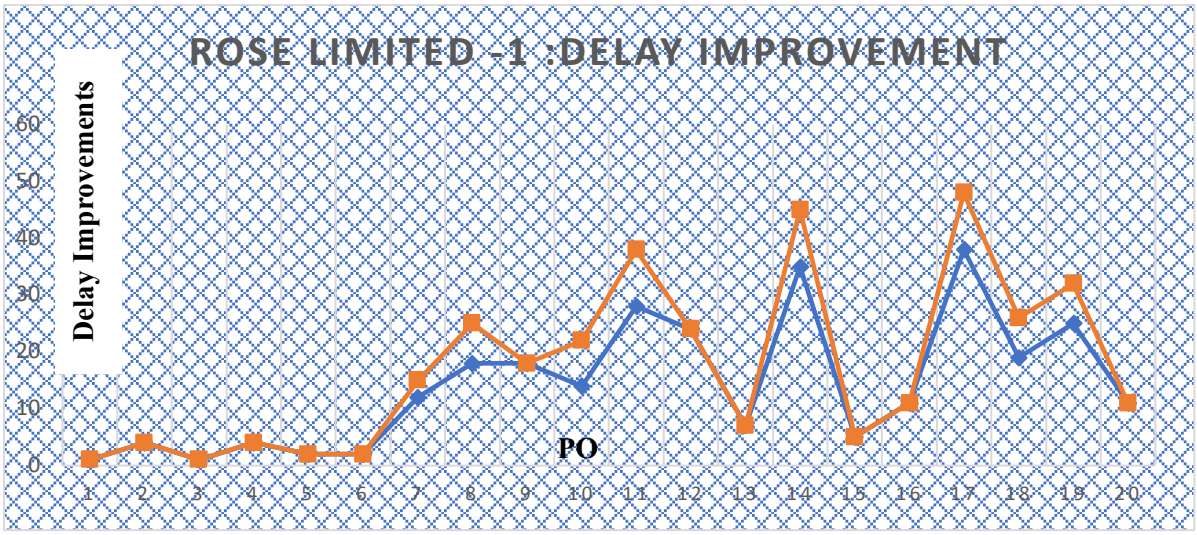



**Figure 9:** Optimized Delay Improvements (PU-1)

Figure 9 shows the reflection of the delayed delivery improvement while bringing raw materials from the analytically selected suppliers through the cost ratio and dimensional analysis method for the production unit 1. The receiving date and delivery date are very close, which is manageable to keep the smooth production and get the best outcome, which leads to higher efficiency.

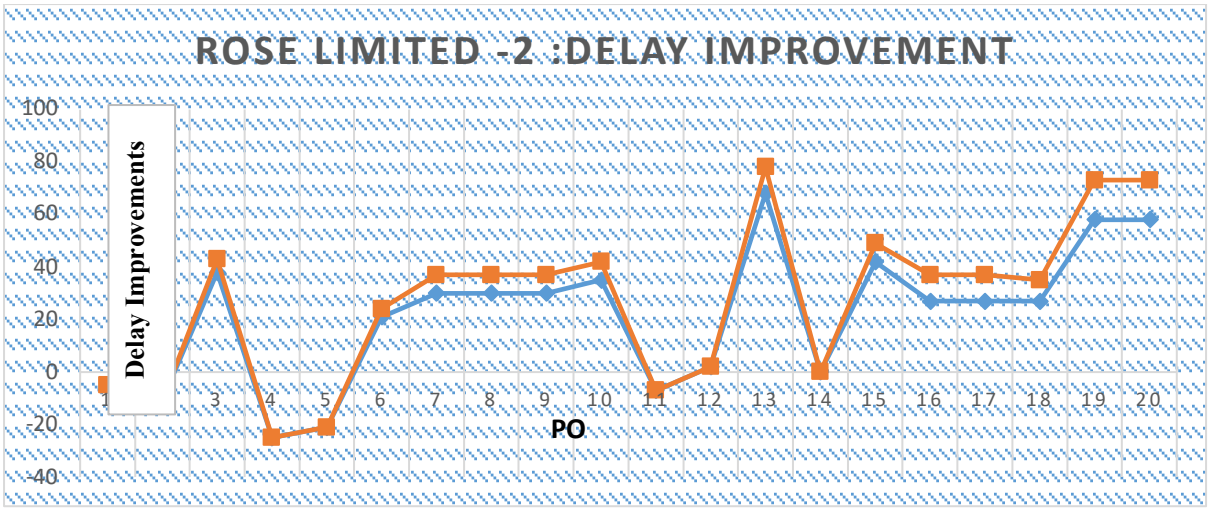



**Figure 10**: Optimized Delay Improvements - (PU-2)

The same is true for manufacturing unit 2. Figure 10 displays the enhancement of the delay days, which is very narrowed to the actual receiving date. The study shows that 95% of the on-time tracking (OTT) or actual receiving dates are met. That implies that the delivery commitment of the selected suppliers is correct and the results are result-oriented. As a result, production units 1 and 2 are able to produce goods and ship them at the right time. The efficiency level of production units 1 and 2 has increased by 15%–20%, which is shown in Figures 11 and 12.

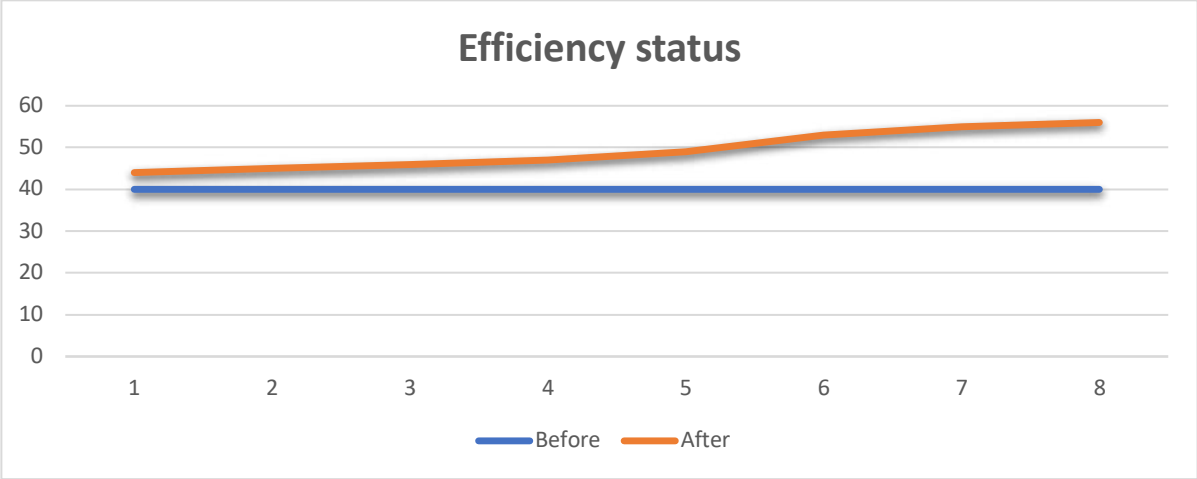



**Figure 11:** Comparison of Efficiency Improvement Status (PU-1)

The comparison of the efficiency improvement status while purchasing the materials from conventional suppliers and the best results after sourcing the raw materials from the right suppliers at the right time is shown in Figures 11 and 12 for the production units 1 and 2 successively.

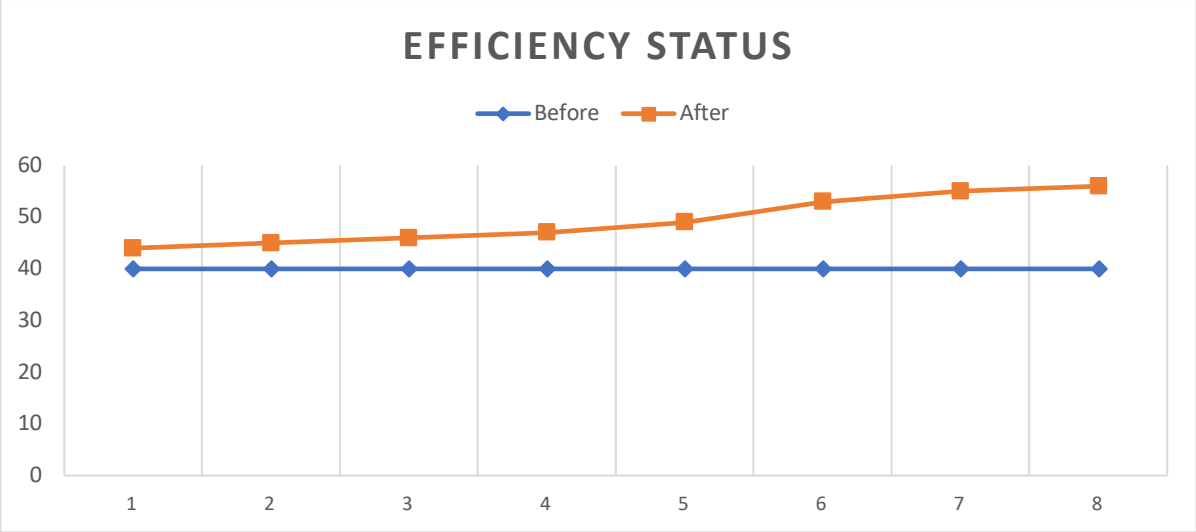



**Figure 12:** Comparison of Efficiency Improvement Status (PU-2)

## 4. DISCUSSIONS

The company pays more money to get optimized supply chain in the apparel manufacturing industry. In this research, the analysis has been made based on the conventional supplier's delivery status and the improvement status after the scientifically selection of the right suppliers by the performance evaluation of that suppliers using dimensional analysis method and cost ratio analysis method. It has been found that suppliers selected through analytical study, were able to provide the materials to the manufacturer warehouse on time to meet the shipment which leads to increase the efficiency. Overall, the supply chain optimized because of the reduction of the time and cost.

## 5. CONCLUSIONS

The mission and vision of the apparel manufacturing industry is to make a profit by cutting costs in all echelons of the supply chain. The majority of the product cost is incurred on materials rather than manufacturing costs (CM). It is observed that 30% of the FOB (freight on-board) price for any garment acquired for cutting and making charge, while the remaining 70% is acquired for the materials cost. Hence, sometimes it is impossible to make money with CM costs. In this case, the manufacturers must save money on materials and transportation costs by optimizing the overall supply chain. To accomplish this task, the selection of the right suppliers is one of the biggest jobs for the apparel manufacturers. Henceforth, the right supplier's selection is the crucial factor as the money saving depends on time materials received and the better quality of the resource. In this research, the data is taken from two apparel manufacturing organizations to analyze the current status of the materials received as well as the profit margin scenario. It is originated that the timely material delivery status is 60%, where the possible loss for the manufacturing unit is 40% for the undelivered materials on time. In this case, the manufacturers are unable to ship the goods on time. Accordingly, a factory cannot make enough money to pay the workforce's salary within the specified period, which means depreciating the better working environment. That's why the analysis is completed to select the right suppliers to get the materials on time. The cost ratio analysis and dimensional analysis methods are implemented to identify the criteria and would be able to take the decision for the right supplier's selection at the right time to get the best service in the case of delivery, quality, and cost. The efficiency is dramatically improved for the selected manufacturing unit since the materials are taken from the

analytically selected best suppliers. The rate of on-time delivery is drastically heightened compared with the previous status, merely because of the right supplier's selection. The analysis for the right supplier's selection could be done by applying more methods to ten manufacturing units to get more precise results. That would be the future research recommendation.

### Data Availability Statement:

The basis data supporting the results of this research are stated in the manuscript.

## REFERENCES

Alam, F. M., McNaught, K. R., & Ringrose, T. J. (2004). A comparison of experimental designs in the development of a neural network simulation metamodel. Simulation Modelling Practice and Theory, 12(7-8): 559-578.

Akter, S. , Ji, X. , Sarker, M. , Cai, L. , Shao, Y. , Hasan, M. , Abir, S.,& Quan, V. (2020). Clean Manufacturing and Green Practices in the Apparel Supply Chain, Open Journal of Business and Management, 8, 104-113. doi: 10.4236/ojbm.2020.81007."

Birch, D. (2001). Made for each other? Supply Management, pp.42-43.

Beyer, H. G., & Sendhoff, B. (2007). Robust optimization–a comprehensive survey. Computer Methods In Applied Mechanics And Engineering, 196(33-34): 3190-3218.

Bhutta, K. S., & Huq, F. (2002). Supplier selection problem: a comparison of the total cost of ownership and analytic hierarchy process approaches. Supply Chain Management: An International Journal, 7(3): 126-135.

Bal, M., Demirhan, A., (2013). Using rough set theory for supply chain management process in business. In Proceedings of the XI Balkan conference on operational research (BALCOR 2013), Belgrade-Zlatibor, Serbia (pp. 367-374).

Çebi, F., & Bayraktar, D. (2003). An integrated approach for supplier selection. Logistics Information Management, 16(6): 395- 400.

Cheraghi, S. H., Dadashzadeh, M., & Subramanian, M. (2011). Critical success factors for supplier selection: an update. Journal of Applied Business Research (JABR), 20(2).

Choy, K. L., Lee, W. B., & Lo, V. (2003). Design of a case based intelligent supplier relationship management system—the integration of supplier rating system and product coding system. Expert Systems With Applications, 25(1): 87-100.

Cousins, P. D., Lawson, B., & Squire, B. An empirical taxonomy of purchasing functions. International Journal of Operations & Production Management, 2006, 26(7): 775-794.

Davis, T. (1993). Effective supply chain management. Sloan management review, 34(4): 35.

De Boer, L., Labro, E., & Morlacchi, P. (2001). A review of methods supporting supplier selection. European Journal Of Purchasing & Supply Management, 7(2): 75-89.

Haykin, S. (2008) Neural networks: a comprehensive foundation, Prentice Hall.

H. Robbins et al (1951), A Stochastic Approximation method, Ann. Math. Statist. 22(3): 400-407 (September, 1951). DOI: 10.1214/aoms/1177729586.

Kagnicioglu, C. H. (2006). A fuzzy multi objective programming approach for supplier selection in a supply chain. The Business Review, 6(1): 107-115.

Krause, D. R., Pagell, M., & Curkovic, S. (2001). Toward a measure of competitive priorities for purchasing. Journal of Operations Management, 19(4): 497-512.

Karpak, B., Kumcu, E., & Kasuganti, R. R. (2001). Purchasing materials in the supply chain: managing a multi-objective task. European Journal of Purchasing & Supply Management, 7(3): 209-216.

Liao, C. N., & Kao, H. P. (2011). An integrated fuzzy TOPSIS and MCGP approach to supplier selection in supply chain management. Expert Systems with Applications, 38(9): 10803-10811.

Papageorgiou, L. G. (2009). Supply Chain Optimisation for the Process Industries: Advances and Opportunities. Computers & Chemical Engineering, 33(12):. 1931-1938.

Pi, W., & Low, C. (2006). Supplier evaluation and selection via taguchi loss functions and an AHP. The International Journal of Advanced Manufacturing Technology,, 27(5-6): 625-630

Roodhooft, F., & Konings, J. (1997). Vendor selection and evaluation an activity based costing approach. European Journal of Operational Research, 96(1): 97-102.

Srivastava, S. K. (2007). Green supply-chain management: a state-of-the-art literature review. International Journal of Management Reviews, 9(1): 53-80.

Tekin, E., & Sabuncuoglu, I. (2004). Simulation optimization: A comprehensive review on theory and applications. IIE Transactions, 36(11): 1067-1081.

Terzi, S., & Cavalieri, S. (2004). Simulation in the supply chain context: a survey. Computers in Industry, 53(1): 3-16.

Trisna, T., Marimin, M., Arkeman, Y., & Sunarti, T. (2016). Multi-objective optimization for supply chain management problem: A literature review. Decision Science Letters, 5(2): 283-316

Talluri, S. (2002). A buyer–seller game model for selection and negotiation of purchasing bids. European Journal of Operational Research, 143(1): 171-180.

Verma, R., & Pullman, M. E. (1998). An analysis of the supplier selection process. Omega, 26(6): 739-750.

Zhu, J. (2004) 'A buyer seller game model for selection and negotiation of purchasing bids:an extensions and new models', European Journal of Operation Research,Vol. 154(1): 150–156.

JOMAES

Journal of Management and Economic Studies

2022, 4(1): 15-29 DOI: 10.26677/TR1010.2022.956

Journal Homepage: https://www.jomaes.org

# Sustainability of Turkish Banking Sector Credit Mechanism: A Study on Non-Performing Loans

**Mustafa ÖZYEŞİL**

Istanbul Aydın University, Anadolu Bil Vocational School, Business Management (English) Dept. / Turkey

www.orcid.org/0000-0002-4442-7087

mozyesil@aydin.edu.tr

**Abstract**

In this study, the efficiency of the credit mechanism in the Turkish banking system is investigated. The effectiveness of the credit allocation mechanism is analyzed by questioning how much of the increase in total loan volume in the banking system is becoming non-performing loan. For this purpose, the data set consisting of weekly total loan volume and non-performing loan volume for the period January 2015 – July 2021 has been studied. The stationarity of the series is questioned by the ADF Unit root test and the series are found to be stationary. The causality test between the series is examined with the Granger causality test and a bi-directional and statistically significant causality relationship is determined between total loans and non-performing loans series. In the study, Regression analysis is used with OLS method and according to the analysis result, a positive and significant relationship has been determined between loans and non-performing loans. According to the results of the analysis, it has been found out that if the total loans increase by one unit (excluding the fixed term), it is expected that the non-performing loans will increase by 0.05 units. According to the result of this analysis, which shows that approximately 5% of the total loans will be non-performing, it is recommended that banks should apply a more selective valuation during credit allocation decision stages in order to prevent any boost in volume of the non-performing loans as a result of the loosening monetary and fiscal policies especially during the post-Covid-19 period.

**Keywords:** Banking System, Total Loans, Non-Performing Loans, Unit Root Test, Causality Test, Regression Analysis

## 1. Introduction

The financial system is a set of institutions and rules that ensure the flow of funds between individuals and institutions in a country. Within this system, there are real and legal persons who perform the supply and demand of funds, organizations that act as intermediaries in the transfer of funds, and regulatory institutions that provide supervision and audit services on behalf of the government. It is very curicial for the financial system to be sound, sustainable and secure in terms of ensuring that savings are converted into investments and thus achieving the growth of the country's economy.

The banking system has the largest share in the financial system in Turkey. According to the data of the Banking Regulation and Supervision Agency (BRSA) for 2021, 80% of the total assets of the financial system belong to the banking system. For this reason, the safe and efficient operation of the banking system plays a key role in the success of the financial system and general economy in Turkey.

As it is known in the simplest terms, banks are financial institutions that bring together the economic units that have savings (savers/suppliers) and economic units that have a savings deficit (borrowers/demanders), that transfer funds through the credit mechanism and create fiat money. The banking crisis experienced in our country in 2000 brought the concept of risk management to the agenda in the banking system. Due to the inability of Turkish banks to effectively implement risk management practices before 2000s, 20 banks, corresponding to 25% of the total number of banks in the sector, went bankrupt during the 1997-2001 period and were transferred to the Savings Deposit and Insurance Fund (SDIF) (Gunay and Tektas, 2006:418). After this crisis erupted in 2000-2001, very important legal regulations on risk management in Turkish banking were prepared by money and capital market regulators, and the compliance process of banks with these, especially with Basel criteria, was carefully monitored and managed. During the last 20 years, a sense of trust has prevailed in the Turkish banking system, thanks to the very careful approach of banks in credibility assessment and the high degree of compliance with Basel criteria. As a result of effective risk management practices, Turkish Banks have had a much higher Capital Adequacy Ratio (CAR) than banks from many European countries. Thanks to the measures taken after the 2001 crisis, the ratio of banks' equity to total risky assets (credit risk, market risk and operational risk) has always remained above 10% (Dincer et.al, 2011:1534). In fact, Turkish banks were among the banks that were least affected by the global financial crisis that broke out in 2008, thanks to the aforementioned successful risk management practices.

Along with the positive developments mentioned above, there are also negative developments observed in the Turkish economy during a nearly last decade.

Slowing economic growth, increasing unemployment and inflation rates, the economic consequences of regional problems such as war and natural disasters, and the global monetary policy implemented by the US Federal Reserve, etc. Slammed Turkish Lira and it depreciated against many currencies, especially the US Dollar. The Turkish lira is one of the currencies that the most depreciated against the US Dollar, and Turkey has negatively differentiated from other countries even from fragile five countries. In addition to all these developments, when Covid-19 epidemic, which world has been dealing with for the last 2 years, cause the demand and supply shocks in both domestic and global economy, serious concerns are heard about both the global and Turkish economy. Since China is not among Turkey's export destinations it was expected that the epidemic will not create any shift in terms of export revenues for Turkey. Despite the fact that China is one of the most important origin country in imports, it was expected that the effect of Covid-19 would not have much especially in the short term, thanks to the expectation of the shifts caused by the epidemic in the production facilities from China to other countries (Acıkgoz and Gunay, 2020:521-522). However, due to the rapid spread of the epidemic across to all countries, the economic effects of the epidemic turned also negative for Turkey. Because of declining export volume and tourism revenues, both current account deficit financing has become a bigger problem. moreover, the effect of the crisis began to be felt more deeply with the effect of the expansionary monetary and fiscal policies implemented by the current government to stimulate the economy.

As it is known, during the Covid-19 period, there are measures taken by the governments in the economic field and these economic packages implemented in our country as in the whole world. Due to the economy that came to a standstill during this period, many people lost their jobs, albeit temporarily, and/or did not receive their monthly salary for a while. In order not to cause a demand stagnation, the current government intervened in the economy with loose monetary and fiscal policies. Lots of support has been provided to people such as income support was provided by the government to people who lost their jobs or could not receive their monthly salary, tax debts of companies were postponed, tax reductions were made on many products, etc. One of most important measurements among these are loans provided to individuals and companies with zero or very low interest rates. Thanks to these loans, many companies and real persons suffering from liquidity difficulties were relieved and became able to clear their debts at maturtiy.

In this study, the efficiency of the credit mechanism of the banking system in Turkey will be examined. The efficiency of the credit mechanism will be investigated by calculating the ratio of non-performing loans. The aim of the study is to analyze how much of the loans used in the banking system are / may be bad loans during the January 2015 – July 2021 period. The developments in total loan volume and non-performing loans volume, especially in the post-Covid-19 period, will also be examined.

In the second part of the study, previous studies in the related literature will be examined, in the third part the tests and calculations in the practice part of the study will be performed, and in the 4th part the test findings will be analyzed and interpreted.

## 2. Literature Review

Brei meat. al (2020) examined whether the means of segregating impaired assets, also called bad banks, provide an improvement in the credits of the source banks or a decrease in the volume of non-performing loans. The analyzes are based on a sample of 135 bank data from 15 European countries for the period 2000 – 2016. According to the results of the analysis, it has been determined that bad bank segregating is possible to improve balance sheets only when recapitalization and asset separation practices are applied together.

Stephen et. al (2018), investigated the effect of non-performing loans on bank profitability in the light of information asymmetry and mismanagement hypotheses. They used ordinary OLS method, Fixed Effects and Random Effects method on the dataset consisting of data of 16 commercial banks in Tanzania from 2007 to 2015. As a result of the analysis, a negative significant relationship was found between the non-performing loans of commercial banks and their profitability. In other words, it has been determined that the profitability of banks will decrease as non-performing loans increase.

Dwipayana (2020) analyzed the quality of loans in the fintech P2P loan system consisting of 72 firms in Indonesia. In his research, he examined the quality and data trend of loans during the January – October 2018 period. According to the results of the analysis, it was determined that the debtor and creditor accounts increased by 10.8 and 1.8 times, respectively, in the analysis period compared to the previous year. He emphasized that most of the loans in the P2P loan system are current loans with a maturity of less than 30 days. The ratio of current loans was calculated as 97.09% on average. The ratio of non-performing loans was calculated as 1.03% and the situation was interpreted positively in terms of the quality of loans in the P2P loan system.

Adusei (2018) analyzed the determinants of non-performing loans in the Ghana banking system using the annual historical time series for the 1998-2013 period with Seemingly Unrelated Regression and Principal Component Analysis method. According to the analysis result; money supply and financial development were found to be a significant determinant of non-performing

loans. In addition, it has been determined that macroeconomic variables other than real income are also significant determinants of nonperforming loans.

Messai and Jouini (2013), analyzed the macro and micro determinants of non-performing loans. They conducted a study covering the analysis period of 2004-2008 on a sample of 85 banks stemming from Italy, Spain and Greece. The authors stated that all three countries are among the countries most affected by the global financial crisis that started in 2008, and therefore they were taken into the sample. GDP growth rate, unemployment rate and real interest rates were included in the analysis as macro determining factors while return on assets (ROA), loan change ratio, loan loss reserves to total loans ratio were used as micro-determining factors. According to the results of panel data analysis, it was determined that non-performing loans were negatively associated with GDP growth rate and banks' return on assets, and positively associated with unemployment rate, loan loss reserves to total loans ratio and real interest rates.

Makri et.al (2014) analyzed the determinants of non-performing loans in the European banking system for the period 2000-2008. Both macro and micro variables were included in the analysis. GDP annual growth rate, public debt to GDP ratio, unemployment rate are used as macro variables. On the other hand, loan / deposit ratio, return on assets (ROA) and return on equity (ROE) were used as micro variables. According to the results of the analysis, it has been determined that there is a statistically significant correlation between non-performing loans and both some macroeconomic factors (GDP growth rate, unemployment, public debt ratio) and some micro-variables of banks (capital adequacy ratio, ratio of previous year's non-performing loans and ROE).

Khemraj and Pasha (2009) analyzed the determinants of non-performing loans in the Guyana banking sector using panel data and fixed effect model. According to the results of the analysis, in parallel with the findings in the international literature, it has been determined that real exchange rates have a statistically significant positive effect on non-performing loans. Non-performing loans also increase when there is an increase in the local currency.

Also, they found out that GDP growth rate has negative impact on non-performing loans. Interest rates and lending amount has positive impact on non-peforming loans that suggests when interest is charged higher or lending amount provided to market gets larger, this will trigger non performing loans. In addition to these findings, unlike previous studies in existing literature, they also observed that larger banks are not better in terms of monitoring loans by customers than smaller ones.

Beck et.al (2013) analyzed the macro determinants of non-performing loans by analyzing panel data consisting of 75 countries. According to the dynamic panel results, it has been determined that GDP growth rate, stock prices, exchange rates and lending rate affect non-performing loans significantly. It has been determined that the effect of stock prices is greater in countries where the ratio of stock market to total GDP is higher. Also, the authors found out that effect of exchange is based on size of foreign exchange amount provided to borrowers who are not hedged against to fluctation observed in foreign exchange in a country where exchange rates are pegged.

Skarica (2014) analyzed the determinants of non-performing loans in the banking sector of 7 developing countries in Europe consisting of Bulgaria, Croatia, Czech Republic, Hungary, Latvia, Romania and Slovakia, using panel data and fixed effects model. The analysis period covers the 2007-2012 period. The macroeconomic variables used in the analysis are GDP, uneployment and inlation rate. According to the results of the analysis, the biggest reason for the increase in non-performing loans was determined as the contraction in the economy.

Akinlo and Mofoluwaso (2014) performed a macroeconomic analysis for non-performing loans

in the Nigerian banking system. They worked on the data set covering the 1981-2011 period. In their studies, they examined the relationship between some macroeconomic indicators and non-performing loans for both the short and long term. According to the results of the analysis, a negative relationship was found between economic growth and non-performing loans in the long run, and a positive relationship with unemployment, the amount of loans given to the private sector and exchange rates. In the short-term analysis, it has been determined that the amount of loans given to the private sector, exchange rates, lending rate, stock index are the main determinants of non-performing loans.

Zheng et.al (2020) conducted an analysis on the determinants of NPL in the Bangladesh banking sector. ARDL analysis was performed on a long time series such as 1979 – 2018 and the reliability of the results was tested with the VEC model. According to the results of the analysis, it has been determined that both banking sectoral and macroeconomic factors affect non-performing loan receivables. As industry-specific factors; it has been determined that bank loan growth, net operating profit, deposit rates have a significant negative relationship with non-performing loans, while bank liquidity and lending rates have a significant positive relationship. While GDP growth and unemployment rate, which are among the macro-economic factors, have a negative relationship with non-performing loans, credit and exchange rates have a positive and significant relationship with non-performing loans.

## 3. Analysis and Interpretation of Result

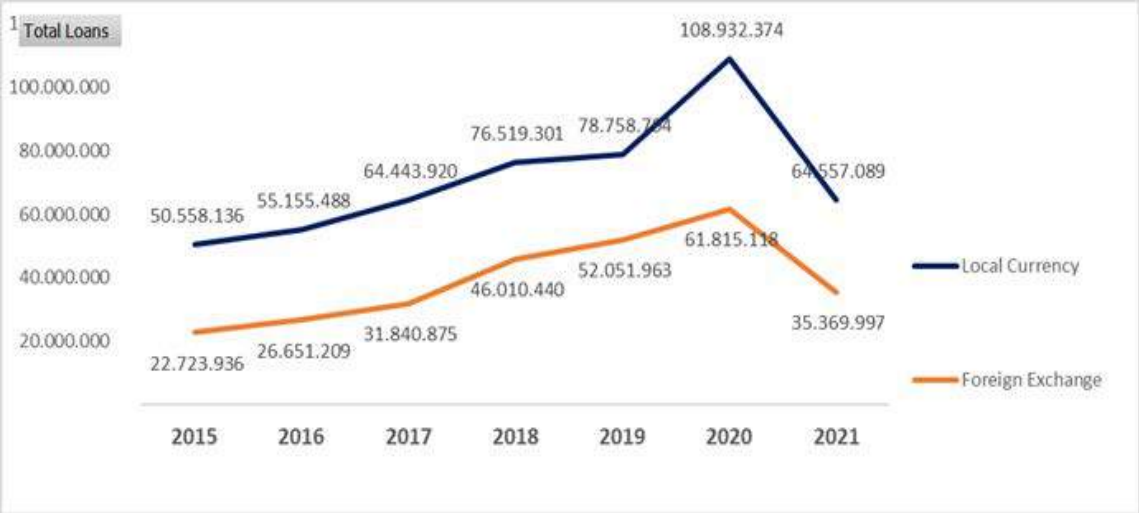
### Data Presentation

The monthly data on Total Loan Volume and Total Volume of NPLs from 2015 to 2021 are presented in table 1 and table 2 respectively in the appendix.

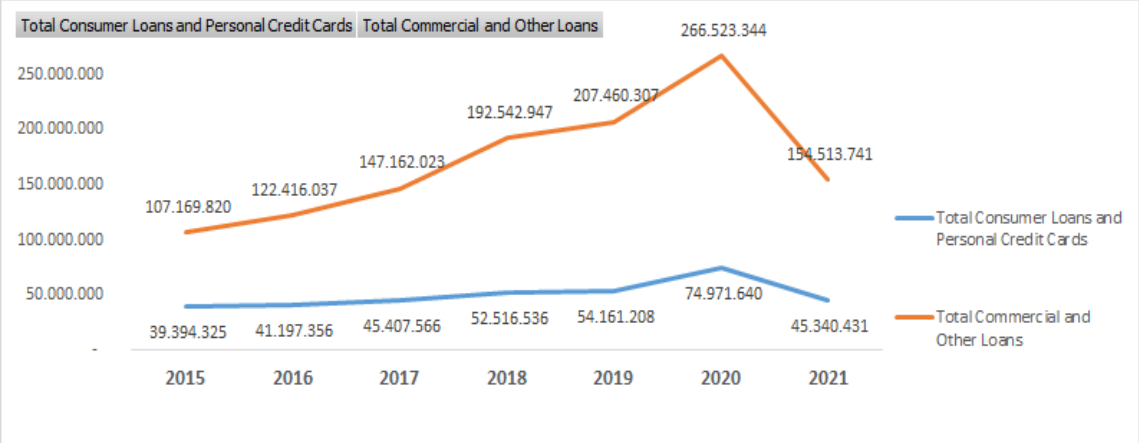
### Data Set and Sample Structure

In this study, the data were obtained from the weekly bulletin of the Banking Regulation and Supervision Agency (BSRA), Turkey's regulatory agency in the field of banking. The period 2015-2021 was determined as the analysis period, and the total number of observations is 340. Total loan volume and non-performing loan volume data were used in the analysis. Analysis of each data on the basis of type and currency was also performed.,

The breakdown of loans in the banking system by type and currency is shown in Chart 1 and Chart 2 respectively as follows:




**Source:** www.bddk.gov.tr **Chart 1. The Breakdown of Total Loans by Currency**




**Source:** www.bddk.gov.tr **Chart 2. The Breakdown of Total Loans by Type**

As can be clearly seen from the graphics, it is seen that the loan volume peaked in 2020 in order to revive the stagnating economic activity in 2020, when the Covid-19 epidemic erupted.

## 4. Methodology

In this study, the relationship between the total loan volume and the volume of non-performing loans in the Turkish banking sector has been examined. For this purpose, linear regression and causality analyzes are applied.

In the study, total banking loan volume is considered as the independent variable, and non-performing loans as the dependent variable. In other words, it will be analyzed to what extent a one-unit increase in the total loan amount causes an increase in the non-performing loans. It is aimed to analyze how much expansionary monetary policies implemented in a country cause bad loans in the banking system. In particular, it is desired to conduct a risk analysis of the increased loan volume as a result of the economic development packages implemented after Covid-19. OLS regression method and Granger (1969) causality tests are applied in the study. Analysis will be peformed through E-views 10 program.

The linear regression applied in the analysis is shown in the following equation:

Dependent variable= Constant coefficient+Independent variable. The equation is

mathematically represented in equation 3 as follows.

$$Y = \alpha + \beta_{yx} * X + \varepsilon \quad (1)$$

The explanation of the notations in the equation is as follows:

Y = The dependent variable,

X= The Independent variable,

$\alpha$ = Constant term

$\beta$ = The coefficient of the independent variable, the degree to which the independent variable affects the dependent variable,

$\varepsilon$ = Error terms

In this study, the existence of causality relationships between the series was examined with the Granger (1969) based causality test. This test is carried out with the help of the following system of equations.

$$Y_{it} = \alpha_i + \sum_{k=1}^{p} \gamma_i Y_{i,t-k} \sum_{k=1}^{p} \beta_i X_{i,t-k} + \varepsilon_{i,t} \quad (2)$$

$$X_{it} = \theta_i + \sum_{k=1}^{p} \delta_i X_{i,t-k} \sum_{k=1}^{p} \varphi_i Y_{i,t-k} \quad (3)$$

Here m; is the ideal (optimal) lag length. Equation (69) investigates casuality from X to Y while Equation (65) tests the existence of a causality relationship from Y to X.

## 5. Test Results

## Descriptive Statistics

Descriptive statistics of the sample are provided in Table 1 as follows:

**Table 1.** Descriptive Statistics

| | **Total Loans** | **Non-Performing Loans** |
|---|---|---|
| Mean | 2280555. | 88606.06 |
| Median | 2205407. | 65610.73 |
| Max | 3901998. | 153577.6 |
| Min | 1225351. | 36395.65 |
| Std. Deviation | 744690.0 | 42101.80 |
| Skewness | 0.559628 | 0.477492 |
| Kurtosis | 1.283358 | 1.587633 |
| N | 340 | 340 |

In Table 1, the descriptive statistics of the variables of total loans and non-performing loans are provided. According to the results, it is understood that the variables of total loans and non-performing loans have a normal distribution since the skewness and kurtosis values vary between +2 and -2.

## Unit Root Test

Before starting the analysis, it is necessary to measure the degree of stationarity of the series. Since there will be an outlier value in the non-stationary series, it will be possible to encounter a spurious regression problem in the analysis to be made. The stationarity of the series is measured by the unit root test.

The results of the ADF unit root test are shown in Table 2 as follows:

**Table 2.** Unit Root Tests

Null Hypothesis: D(Total Loans) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=16)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -6.146901 | 0.0000 |
| Test critical values: | 1% level | -3.449679 | |
| | 5% level | -2.869952 | |
| | 10% level | -2.571321 | |

Null Hypothesis: D(Non-Performing Loans) has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=16)

| | | t-Statistic | Prob.* |
|---|---|---|---|
| Augmented Dickey-Fuller test statistic | | -3.650118 | 0.0053 |
| Test critical values: | 1% level | -3.449797 | |
| | 5% level | -2.870004 | |
| | 10% level | -2.571349 | |

The following hypotheses were developed while determining the stationarity of the dependent and independent variables.

**H0:** The series has a unit root (H0: pi=p=1).

**H1:** There is no unit root in the series. (H0=pi=p<1).

In Tables 1 and 2, the stationarity of the variables was examined. In order to detect a significant relationship between the series in statistical analysis, the variables should not have a unit root. If there is a trend in the time series for the variable, the relationship may be spurious. For this reason, it is related to the stationarity of the variables in the regression models whether they show a false relationship or a real relationship (Sevinç, 2013). Unit root tests are divided into 2 groups as second and first generation tests. Second generation tests have been developed by authors such as Pesaran (2004), Philips and Sul (2003), Moon and Bai and Ng (2004), Perron (2004). First

generation tests were derived by Haris and Tzavalis (1999), Levin, Lin and Chu (LLC) (2002), Fisher Philips and Perron (PP-Fisher ADF), Im, Pesaran and Shin (1997). As can be seen from Table 1, the unit root test result indicates that there is no unit root in the variables, that is, they are stationary. Due to the stationarity of the variables, the null hypothesis (H0), which claims that the series is a unit root, is not accepted.

## Casuality Test

The causality test is used to analyze the interaction between the series included in the analysis. The aim here is to reveal what kind of interaction there is between the series and to indicate which series affects the other.

In this study, Granger (1969) causality test was applied to determine the causality relationship.

The hypotheses of the Granger (1969) causality test:

$H_0$: $\beta_i = 0$ There is no causality from X to Y.

$H_0$: $\beta_i \neq 0$ There is a causal relationship from X to Y.

In the study, Granger (1969) causality test was performed and the results are presented in Table 3.

**Table 3.** Causality Tests

Pairwise Granger Causality Tests

| Null Hypothesis: | Obs | F-Statistic | Prob. |
|---|---|---|---|
| Total Loans does not Granger Cause Non-Performing | 338 | 6.58732 | **0.0016** |
| Non-Performing does not Granger Cause Total Loans | | 4.68451 | **0.0099** |

In Table 3, the relationship between banks' total loans and non-performing loans was tested through granger causality test. According to the results, there is a bidirectional and statistically significant causality between the variables of total loans and non-performing loans ($p<0.05$).

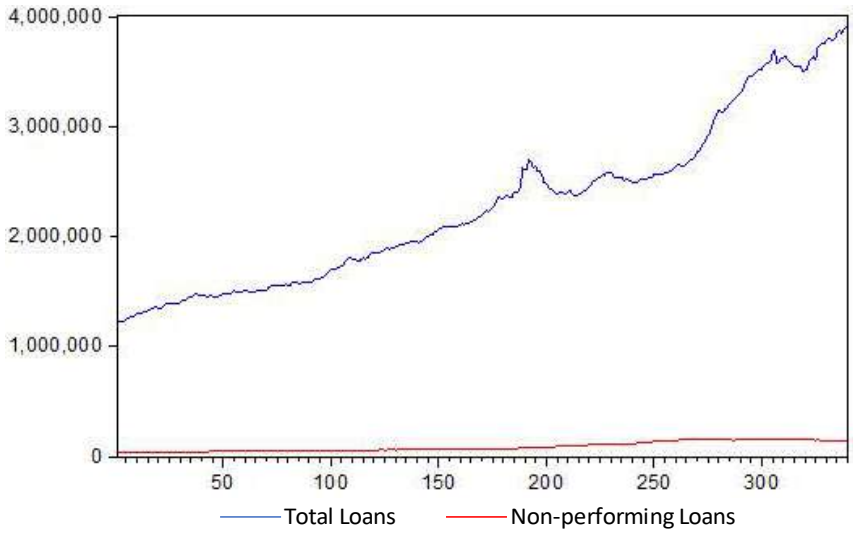



**Chart 3. Total Loans and Non-Performing Loans**

Chart 3 shows the relationship between total loans and non-performing loans. As can be seen from the graph, there is a linear relationship between total loans and non-performing loans. In other words, as total loans increase, non-performing loans will also react positively.

## Model Estimation

In this part of the study, the effect of the independent variable on the dependent variable will be estimated. In other words, the coefficient of the independent variable will be calculated.

For this, the Ordinary Least Squares (OLS) method was applied and the results are shown in Table 4 as follows:

**Table 4.** Estimation Results

Dependent Variable: Non-Performing Loans
Method: Least Squares
Included observations: 340

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| Total Loans | 0.052552 | 0.001134 | 46.34610 | 0.0000 |
| C | -31242.19 | 2719.930 | -11.48640 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.864036 | Mean dependent var | 88606.06 |
| Adjusted R-squared | 0.863634 | S.D. dependent var | 42101.80 |
| S.E. of regression | 15547.24 | Akaike info criterion | 22.14702 |
| Sum squared resid | 8.17E+10 | Schwarz criterion | 22.16954 |
| Log likelihood | -3762.993 | Hannan-Quinn criter. | 22.15599 |
| F-statistic | 2147.961 | Durbin-Watson stat | 0.007999 |
| Prob(F-statistic) | 0.000000 | | |

In Table 4, the effect of total loans on non-performing loans is analyzed by regression analysis. As a result of the analysis, it is understood that total loans have a statistically significant effect on non-performing loans ($p<0.05$). In other words, there is a positive and significant relationship between total loans and non-performing loans. As total loans increase, non-performing loans also increase. The rate of explaining the dependent variable of the independent variable is 86%.

When we apply the regression equation ($Y=\alpha+\beta_{yx}*X+\varepsilon$) to the analysis results, non performing loans can be estimated as follows:

Non-Performing Loans= -31242.19+ Total LoansX0.052552

For example, if the total loans are 1.000.000 TL the amount of non-performing loans will be calculated as follows.

Non-Performing Loans = -31242.19+ 1.000.000X0.052552 then

It can be estimated that the NPLs will be 21.309,81. TL

## 6. Conclusion and Discussions

The financial system is an environment that covers individuals and institutions that supply and demand funds, institutions that act as intermediaries in the transfer of funds, and regulatory institutions that prepare and implement the legal regulations regarding the transfer of funds. The

meeting of the supply and demand of funds within the financial system takes place in the financial markets. The success of financial markets is directly reflected in the growth of a country's economy. For this reason, the depth, development of financial markets and their provided trust have vital importance.

Banks are at the forefront of the most classical and largest players in financial markets. Banks transforms savings into investments through loans they provide to real and legal persons. Thus, with increased investment and employment, both economic development and economic growth will be realized in the given country. However, the credibility of those who request funds should be analyzed very carefully when allocating loans. Otherwise, the profitability and operational efficiency of the banks, which have to compensate for the increasing non-performing loans, will decrease. Moreover, if the inefficiency in the credit valuation process continues, that is, if banks continue to provide loans to uncredited individuals and institutions, this may lead to the bankruptcy of the relevant bank. Since a crisis in the financial system today will have much more effective results than a crisis in the real economy, the result such as bankruptcy of banks may bring along unpreventable crises in the given economy.

In this study, the credit mechanism of the Turkish banking system is analyzed in detail. Data obtained from weekly bulletins of the Banking Regulation and Supervision Agency (BRSA), which is the Turkey's banking regulatory agency in banking field, were used for the 2015 – 2021 period. Two variables as total loan volume and non-performing loan volume, were used in the study. The aim of the study is to observe the trend of non-performing loans over time and to give an idea about the sustainability of the loan mechanism in the country. In the study, non-performing loans were included in the analysis as a dependent variable and while total loans as an independent variable, and regression analysis was applied. In the analysis, the stationarity of the series was examined with the unit root test and it was determined that the series were stationary at their original level values.

According to the results of the analysis, a statistically significant positive relationship was found between total loans and non-performing loans. In other words, as total loans increase, non-performing loans will also increase. According to the results of the analysis, the amount of non-performing loans for each 1 mn TL total loan is approximately 21 thousand TL (2.1%). During the analysis period, 2015 – 2021, the share of non-performing loans in total loans varies between 3% and 4.71%. The highest annual increase in non-performing loans was observed in 2019. In 2019, it increased by approximately 58% compared to the previous year and reached to 6.2 billion TL from 3.9 billion TL, and its share in total loans reached its peak with 4.71%. Especially in 2020, when the Covid-19 epidemic erupted, the increase in non-performing loans continued and increased by approximately 38% compared to the previous year, reaching to 8 billion TL from 6.2 billion TL, and its share in total loans was calculated as 4.69%. As a result of the expansionary monetary and fiscal policies implemented by the government in order to eliminate the negative economic consequences of the Covid-19 epidemic and to revive the general economy, which was mentioned earlier in this study, the total loan volume increased by a record 31% in 2020 compared to the previous year and increased from 131 Billion TL and reached to 171 billion TL.

Some of this increased loan volume was reflected in non-performing loans due to economic units were not affordable to clear their debts on due time, and therefore non-performing loans broke the peak level in 2019 and reached a new peak level in 2020. As of July 2021, when the analysis was made, an improvement was observed in non-performing loans. Non-performing loans decreased by approximately 51% compared to 2020 and their share in total loans was calculated as 3.90%. The status of non-performing loans may also change depending on the macroeconomic developments to be experienced in the remainder of 2021 and the progress of the Covid-19 epidemic.

When analyzed in terms of currency, it is seen that the share of foreign currency loans in total loans during the analysis period 2015 – 2021 varies between 31% and 40%. In general terms, one third of every 1 Turkish Lira in the banking system is foreign currency loans. For this reason, it can be stated that the banking credit mechanism is very sensitive to the movements in exchange rates. The share of foreign loans in non-performing loans is relatively low. The ratio of non-performing loans in foreign currency loans varies between 2% and 3% in the 2015 – 2018 period. However, the rate of non-performing loans increased to 5% in 2019 and to 9% in 2020. It is thought that this situation is caused by the unpaid loans of companies and real persons whose business volumes have decreased due to the stagnating global economic activity due to the Covid-19 epidemic.

When analyzed as a loan type, it is observed that approximately two-thirds of non-performing loans consist of Commercial Loans. In the period of analysis, 2015 – 2021, the share of commercial loans in non-performing loans varies between 64% and 87%. Especially in 2020, when the Covid-19 epidemic broke out, the share of commercial loans in non-performing loans reached the peak of all time with 86%. It should be highlighted that this situation is due to the fact that the decreased commercial mobility due to Covid-19 caused a deterioration in the financials of the companies.

As a result, the rate of non-performing loans has been increasing over time, but this increase has reached higher levels with the Covid-19 outbreak. The interventionist practices implemented by the government in the economy increase the liquidity of individuals and institutions in the short term, but if the effect of the epidemic on economic activity continues, the volume of non-performing loans is expected to increase. Therefore, it is recommended that the authority should be more careful than ever in the allocation of loans, except for economic packages such as support loans given to bail out failed firms.

### Importance of the Study and Suggestions for Further Studies

In this study, the relationship between non-performing loans and total loan volume was investigated by analyzing the annual data of the last 6 years. The aim of the study is to examine the results of the money easing policy applied in the money market (credit mechanism) in order to stimulate the economy, especially in the post-Covid-19 period. We consider the empirical results of this study important in terms of examining the practices of regulatory agencies. In the continuation of this study, it is important to carry out studies such as the effect of non-performing loans on the profitability of the sector, macro and micro determinants of non-performing loans, and detailed analyzes of non-performing loans on the basis of bank type and maturity, in terms of presenting more effective solution proposals to regulatory institutions.

## References

Acıkgoz, O. and Gunay, A. (2020). The early impact of the Covid-19 pandemic on the global and Turkish economy, Turkish Journal of Medical Sciences, 50, 520-526.

Adusei, C. (2018). Determinants of Non-Performıng Loans in The Bankıng Sector of Ghana between 1998 and 2013, Asian Development Policy Review, 6(3), 142-154.

Akinlo, O. and Mofoluwasa, E., O. (2014). Determinants of Non-Performing Loans in Nigeria, Accounting & Taxation, 6(2), 21-28.

Beck, R., Jakubik, P. and Piloiu, A. (2013). Non-Performing Loans: What Matters in Addition to the Economic Cycle?, ECB Working Paper No. 1515, 1-34.

Brei, M., Gambacorta, L., Lucchetta, M. and Parigi, B., M. (2020). Bad Bank Resolutions and Bank Lending, BIS Working Paper No. 837, Available at SSRN: https://ssrn.com/abstract=3535900

Dickey, D. A. and Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74(366a), 427–431.

Dincer, H., Gencer, G., Orhan, N. and Sahinbas, K. (2011). A Performance Evaluation of the Turkish Banking Sector after the Global Crisis via CAMELS Ratios, 24, Procedia - Social and Behavioral Sciences, 1530 – 1545.

Dwipayana, D., P. (2020), Legal Protection for Debtors of Online Loans, Jurnal Ilmu Hukum, Universitas PGRI Madiun, Indonesia,4(1), 46-56.

E.N. Gunay and A. Tektas. (2006) Efficiency analysis of the Turkish banking sector in precrisis and crisis period: a DEA approach. Contemp. Econ. Policy, 24, 418–431.

Granger, C.W.J. (1969). Investigating Causal Relations by Econometric Models and Cross-Spectral Methods. Journal of Econometric Society, (37). 424-438.

Gujarati, D.N. (2004). Basic Econometrics, Fourth Edition McGraw Hill.

Khemraj, T. and Pasha, S. (2009). The determinants of non-performing loans: an econometric case study of Guyana, New College of Glorida, University of Guyana, MPRA Paper No. 53128, 1-26.

Makri V., Tsagkanos A., & Bellas A. (2014). Determinants of Non-Performing Loans: The Case of Eurozone. Panoeconomicus, 61(2), 193-206.

Messai, A. and S., Jouini, Fathi. (2013). Micro and Macro Determinants of Non-performing Loans, International Journal of Economics and Financial Issues, 3 (4), 852-860.

Skarica, B. (2014). Determinants of non-performing loans in Central and Eastern European countries, Financial Theory and Practice, 38(1), 37-59.

Stephen Kingu, P., Macha, D. S. and Gwahula, D. R. (2018). Impact of Non-Performing Loans on Bank's Profitability: Empirical Evidence from Commercial Banks in Tanzania. International Journal of Scientific Research and Management, 6(1), 71-79.

https://www.bddk.org.tr/bultenhaftalik [Date of access: 02.07.2021].

## APPENDIX

**Annex-1: Monthly Total Loan Volume During the 2015 – 2021 Period (Average, Million TL)**

| Months / Years | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Grand Total |
|---|---|---|---|---|---|---|---|---|
| 1 | 6.178.153 | 5.982.795 | 3.561.749 | 8.396.065 | 9.583.335 | 13.272.396 | 17.778.430 | 64.752.924 |
| 2 | 5.089.004 | 6.008.971 | 7.132.807 | 8.477.975 | 9.554.775 | 10.887.192 | 14.116.190 | 61.266.913 |
| 3 | 5.223.453 | 5.996.867 | 9.027.702 | 10.835.165 | 12.304.895 | 11.302.767 | 14.556.612 | 69.247.462 |
| 4 | 6.687.895 | 7.555.560 | 7.409.544 | 8.915.960 | 10.136.589 | 15.022.052 | 18.841.283 | 74.568.884 |
| 5 | 5.423.257 | 6.185.772 | 7.505.412 | 9.237.575 | 12.847.768 | 12.580.165 | 15.221.489 | 69.001.437 |
| 6 | 5.551.971 | 6.211.735 | 9.496.947 | 11.789.616 | 10.140.219 | 12.845.964 | 15.511.084 | 71.547.536 |
| 7 | 7.003.999 | 7.847.205 | 7.719.673 | 9.561.236 | 10.046.683 | 16.529.915 | 3.901.998 | 62.610.708 |
| 8 | 5.747.961 | 6.321.362 | 9.754.974 | 12.991.493 | 12.510.405 | 13.818.110 | | 61.144.305 |
| 9 | 5.884.631 | 7.959.474 | 7.860.414 | 10.532.142 | 10.097.278 | 14.031.188 | | 56.365.127 |
| 10 | 7.302.270 | 6.477.855 | 8.069.548 | 10.121.235 | 10.225.615 | 17.944.396 | | 60.140.919 |
| 11 | 5.814.291 | 6.670.738 | 8.282.372 | 12.081.122 | 12.868.798 | 14.472.236 | | 60.189.556 |
| 12 | 7.375.187 | 8.588.364 | 10.463.653 | 9.590.156 | 10.494.397 | 18.041.112 | | 64.552.869 |
| **Grand Total** | **73.282.072** | **81.806.697** | **96.284.794** | **122.529.741** | **130.810.758** | **170.747.492** | **99.927.086** | **775.388.640** |

**Annex-2: Volume of Monthly NPLs During the 2015 – 2021 Period**

**(Average, Million TL)**

| Months / Years | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | Grand Total |
|---|---|---|---|---|---|---|---|---|
| 1 | 182.912 | 191.964 | 232.610 | 252.841 | 391.740 | 753.779 | 606.543 | 2.612.391 |
| 2 | 150.625 | 197.494 | 237.845 | 257.064 | 403.223 | 609.269 | 603.437 | 2.458.957 |
| 3 | 153.598 | 203.219 | 301.756 | 325.168 | 526.395 | 611.133 | 599.565 | 2.720.833 |
| 4 | 196.028 | 258.979 | 182.763 | 264.807 | 430.020 | 758.025 | 744.359 | 2.834.982 |
| 5 | 159.550 | 211.698 | 244.465 | 268.874 | 550.184 | 603.550 | 594.465 | 2.632.787 |
| 6 | 162.395 | 215.915 | 306.832 | 345.729 | 455.639 | 600.274 | 594.944 | 2.681.729 |
| 7 | 208.859 | 266.954 | 306.346 | 297.663 | 468.803 | 753.462 | 149.224 | 2.451.311 |
| 8 | 169.456 | 209.291 | 311.387 | 389.868 | 606.046 | 602.039 | | 2.288.087 |
| 9 | 173.979 | 270.383 | 251.611 | 327.921 | 502.687 | 602.782 | | 2.129.364 |
| 10 | 224.778 | 222.083 | 250.414 | 348.586 | 543.369 | 756.135 | | 2.345.365 |
| 11 | 182.184 | 226.184 | 253.682 | 450.342 | 704.769 | 603.375 | | 2.420.536 |
| 12 | 232.183 | 285.901 | 316.624 | 375.329 | 584.761 | 754.922 | | 2.549.720 |
| **Grand Total** | **2.196.549** | **2.760.065** | **3.196.336** | **3.904.192** | **6.167.636** | **8.008.744** | **3.892.539** | **30.126.061** |

JOMAES

Journal of Management and Economic Studies

2022, 4(1): 30-46 DOI: 10.26677/TR1010.2022.957

Journal Homepage: https://www.jomaes.org


# Rural Electrification and Sustainable Planning of Sukuk Financing within the Isolated Communities in Nigeria: Using Investment and Blockchain Technology

**Tijjani MUHAMMAD**
Federal University, Gashua, Yobe State, Department of Islamic Studies (Islamic Banking and Finance), Nigeria.
orcid.org/0000-0002-7628-8587
hajiteee@gmail.com

**Suleiman Alhaji DAUDA**
Federal University, Gashua, Yobe State, Department of Economics and Development Studies, Nigeria.
orcid.org/0000-0002-2668-7520
suleh2011@gmail.com

**Aisha BUKAR**
Ami-Ham Company Nigeria Limited, Marketing Manager, Nigeria.
orcid.org/0000-0001-8951-3782
aishabk91@gmail.com

**Abstract**

The Renewable Energy system enhances rural communities' development in the country, specifically in North-East and North-West, Nigeria. The ability to overcome extreme poverty and improve their living conditions is related to the renewable energy technology available. The rural electrification planning approach consists of socioeconomic, environmental, and institutional sustainability dimensions. This study establishes specific objectives to achieve sustainability in rural electrification programs. Conceptual frameworks are proposed for achieving universal access anywhere with similar experiences. The methodology is proposed to 3000 isolated communities in North-East and North-West, Nigeria that lack electricity. Three different strategic approaches are formulated as a research-based investment analysis framework. Confirmatory Factor Analysis under Structural Equation Modelling is shown in Figure 2. While figure 3 addressed the technology aspect through blockchain technology. The findings of this work are intended to contribute to the improvement of rural electrification programs with Renewable Energy (RE) of the solar system.

**Keywords:** Rural Electrification, Sukuk, Investment Framework, Block chain, Technology

## Introduction

Nigeria has unique socio-economic, political, geographical, and demographical characteristics that have direct implications on the development of the country. Nigeria is the and most populated black nation in the world, and the most culturally diverse with more than 300 tribes. Economic development of Nigeria has flourished over a decade and has contributed to poverty reduction, and also uplifted the country's economics (Afolabi, 2015). Despite the achievement and positive ongoing socio-economic developments in the country, Nigerians are experiencing immense challenges in electricity supply. For example, the capacity demand in the current situation is estimated to grow at a rate of 6 per cent annually (Oyedepo, 2012). However, it is projected that 45 million rural and some parts of urban citizens have no access to electricity, and the huge percentage of over 3000 rural areas are un-electrified population is located in rural areas. While the low consideration of low electrification significantly undermines the potential economic development of the country and specifically poverty alleviation (Loayza, and Raddatz, 2010). There is a need for the Nigerian government to investigate the solution and renewable energy to address the growing electricity in the rural area, where the national grid is not visible and yet to be seen and considered in the remote area in the country. Consequently, the Nigerian government is targeted to provide a solution to a huge per cent in the remote and rural areas to boost the country's economy based on electrification (Bhattacharyya & Palit, 2016).

Furthermore, to achieve all targets, the Nigerian Government realised that the government's budget is insufficient to fund all expenses and the initial capital investment of the sector for all remote and rural areas around the country. Rural electrification can be expensive specifically in the African countries where the population is sparsely huge. In previous years, the government is preparing to deploy more companies to render services proposed to issue a significant subsidy to the sector to enable both end-users and investments to enjoy (Nilsson, Lucas & Yoshida, 2013).

Moreover, the current trend in the power sector appears to indicate that the investment in the sector is considered below expectation due to the initiation and understanding of the appropriate issues as needed. In recent time, the government is largely experiencing scarcity in national income. The resource declines due to dwindling of crude oil, at the same time, there is a rapid increase of fuel importation, while remote and rural electrification experience decrease of government investment in the sector (Williams, Jaramillo, Taneja, & Ustun, 2015). The research aims to bridge the gap between electricity and demand by inviting private sectors and individuals to play a greater role in addressing the energy sector. Although policies have been implemented in a bid to overcome and encourage individuals and private investments to key on into the power sector, yet the system experiences insufficient investment and resources to manage the sector (Abdulrahman, Gunasekaran, & Subramanian, 2014). Therefore, Sukuk under the Islamic financial system should be used to address funding based on ethical funding to promote the sector toward enhancing the national grid as well as rural electrification in Nigeria.

Currently, about 61 per cent of the North-East and North-West rural communities remain without constant electricity in the geographically most remote and poorest areas of North-East and North-West of Nigeria (Ayadi, 2012). Access to reliable, sustainable, and modern electricity is indispensable for achieving development goals, such as eradicating extreme poverty, increasing food production, accessing safe drinking water and public health services, raising economic opportunities, equity, gender, and quality education (Aikman & Rao, 2012). The overall electrification rate is mainly due to expanding urban networks and new access points in rural communities. For instance, Latin American countries have shown a significant increase in rural electrification rates due to the direct intervention of the governments in the planning, financing,

and execution of national rural electrification programs in the same situation in Australia, Brazil, and other countries around the world.

This culmination in the creation of the rural electrification Agency in 2006 was dedicated purposely for grid extension, isolated mini-grid systems, and renewable energy power generation. However, rural electrification in Nigeria deploys a new lease of life through the Decentralized Renewable Energy solutions by the country's states and the Federal Government. This rural electrification model is to be replicated by the 36 states through their rural electrification boards, focusing on grid extension to rural communities. Furthermore, Nigeria's rural electrification rate still stands at only 39 per cent, with approximately 120 million people living in darkness (Yetano et al., 2020).

The cost of grid extension has limited access due to the estimated cost of the project at $10,000 per kilometre, which scarcely brings a return on investment, considering that many rural customers use much less power than supplied. Most rural consumers of the grid electricity are not metered, and they are not ready to pay electricity bills (Phadke, Park, & Abhyankar, 2019). However, people considered the power supplied as a social good by the government; instead, a service rendered and needs to be paid. Today, technology has opened the global possibilities for increasing rural electrification through Decentralization of Renewable Energy (DRE) solutions by mainstreaming DRE into their rural electricity policies and rural plans using solar energy, for making it easier to partner with private investors as suggested with Sukuk funding and having specific mini-grids policies. The objectives of the research are, (1) To develop a project plan based on the two most globally accepted concepts, energy trilemma and sustainability dimension through Sukuk financing, (2) To enhance access to energy through regulating reform, marketing structure, efficiency and institutional capacity to boost the country's economy through block chain technology in revenue generation, and (3) Propose an approach to develop an investment mode based on renewable energy technology based on rural electrification within the national energy programmes and policies through using solar. The hypotheses proposed are as follows:

H1 Government regulation significantly enhances sustainable rural electrification
H2 Regulatory Authorities significantly enhances sustainable rural electrification
H3 Affordable Utility services significantly enhance sustainable rural electrification

**Literature review**

The electrification planning approach may be classified as different levels or scales of application, such as regional planning or national rural electrification programs. Rural or regional planning focuses on the detailed particulars of specific communities that are well-defined and located in a certain territory with the same or similar characteristics and conditions. For example, Falcón-Roque, Marcos Martín, Pascual Castaño, Domínguez-Dafauce and Bastante Flores (2017) developed a regional proposal planning which is applied to the province of (Peru) Cajamarca, a region having extreme conditions of lowest electrification with a very significant number of dispersion of houses within the communities. However, regional planning approaches at the national level cannot produce good results due to the direct extrapolation. Based on this, the national rural electrification programs do not consist of an extension of regional planning approaches, but that can be referred to as a global agenda and objectives established at the higher national energy policy level and to be considered with an agreement as to the main aspect of the objectives and execution of the strategy initiation. The reviewed approaches for national rural electrification programs aimed at developing large power generation, which can be financed based on Sukuk financing and have three attributes (generating, transmitting, and distributing). Singh and Sharma (2017) reviewed different national planning approaches and concluded that most approaches focused solely on the distribution and performance of electrical networks. In

conjunction, the approach here is to improve national rural electrification programs and offer assistance to decision-making to obtain a national projects portfolio; through the solar system or wind, however, solar is most preferable in the North-East and North-West; (Pereira et al., 2011), India (Alla, Agaev & Torkunova, 2018), China (Jebaraj & Iniyan, 2006), and Venezuela. Shyu (2012) investigated the township of China and analyzed the township electrification from a policy point of view, but did not consider the long-term sustainability. Slough et al. (2015) and Pereira et al. (2010) investigated Brazil's light programs and analyzed all approaches. The results were similar to Shyu's (2012) investigation. Mitra (2009) examined the electrification from renewable energy on small islands, including Cuba, using techno-economic aspects. Buyukozkoto and Karabulut (2017) applied a sustainability perspective for energy projects for concrete and better selecting multi-criteria decision-making, but not on rural electrification. Chaurey and Kandpal (2010) analyzed a techno-economic evaluation, performance, and monitoring of the various system and environmental implications based on decentralized rural electrification programs. The plans were carried out without a standard structured approach to decision-making, which is considered a new contribution of this research. The proposed approach aims to develop an investment need for Renewable Energy Technology based on rural electrification within the national energy programs and policies through using solar.

**Status of electricity in Nigeria**

Nigeria is considered the largest population country and economy in the Sub-Saharan African continents but experiences a huge challenge and limitations in the energy or power sector which prevent the growth of the sector. Nigeria is blessed with gas, oil, solar and hydro resources, which has the potential focus to generate electric power of 12,522 MW from the available and existing plants. Thus, plants generate and dispatch around 4000 MW, which is considered insufficient to the country that has approximately 200 million people. With such, the Nigerian power sector is experiencing broad and massive challenges related to all parts of power, including electricity policy enforcement, gas supply, regulatory uncertainty, transmission system constraints, and planning power sector shortfall that hinder the sector from reaching commercial viability as current access rate in the urban is 86 per cent and rural is 34 per cent.

**Table 1 Hydroelectric in service**

| **Power Stations** | **Capacity** | **Year completed** | **Name of reservoir** |
|---|---|---|---|
| Kainji Power Station | 800 MW | 1968 | Niger River |
| Jebba Power Station | 540 MW | 1985 | Niger River |
| Shiroro Power Station | 600 MW | 1990 | Kaduna River |
| Zamfara Power Station | 100 MW | 2012 | Bunsuru River |
| Total MW need 12,522 | **2040 MW** | | |

**Table 2 Hydroelectric Under construction**

| **Power Stations** | **Capacity** | **Expected Year of completion** | **Name of reservoir** |
|---|---|---|---|
| Kano power station | 100 MW | 2015 | Hadejia River |
| Zamfara power station | 100 MW | 2012 | Bunsuru River |
| Dadin Kowa Power station | 40 MW | 2018 | Benue River |
| Mambila power station | 3050 MW | 2024 | Donga River |
| Total MW | **3280 MW** | | |

**Issues of renewable energy based on rural electrification form the Literature**

The programme of rural electrification uses renewable energy trends to categories due to the low-income customers based on donor dependency. A very common problem for renewable energy in developing economies is a grid extension as shown in the tables above that needed 12522 MW

approximately, however, the country is yet to generate 5000MW. This is also often used based on political reason rather than the primary need for an economic boost. For example, in Bangladesh, the solar project was abandoned due to an election commitment to extend grid electricity (Almeshqab & Ustun, 2019). Same scenario with Nigerian government where the grid station of Mambila power station was also abandoned since 2009 due to the demise of the former late President of Nigeria Umar Musa Yar'adua in 2009. However, the project resumed due to regional politics, not economic motivation (Malamud & Gardini, 2012).

Another issue is the unsuitablepolicy implementation framework, which is considered an ineffective utilization of renewable energy. For instance, in Sri Lanka, the national energy authorities focus on energy planning due to their commercial orientation for sustainable development, however, the micro-level can only be addressed through decentralize system, which directly contributes to the economy significantly. Such a call for decentralization is not in place and the ministries do not act or create a version or made to look beyond urban electrification. Same with the Nigerian case at the moment the innovation has been a drive to address issues and challenges faced by the government as the agents of corruption that fight to vitiate and create chaos for the demolishment of the system. Urmee, Harries and Schlafer (2009) categorized the problems or barriers of renewable energy into three different dimensions, legal and regulatory system, economic, financial, and institutional.

Moreover, the categories of the barriers include economic which indicates lack of subsidies and high capital cost in renewable energy, lack of pricing policy, and inadequate legal framework. In addition, the financial and institutional barriers include lack of access to credit for both investors and customers to make an economic decision. As in Nigeria, the political will is not there and the summary of the issues and problems with their respective authors is indicated in the Table 3.

**Table 3 Issues related to rural electrification reviewed from Literature**

| **Main issues** | **Category** | **Author** |
|---|---|---|
| Lack of funding | Economic | Sinaga et al. (2019) |
| High Capital cost | Economic | Heck et al. (2016) |
| Lack of access credit | Economic | Talavera et al. (2015) |
| Uncorrelated with income generation | Economic | Candelise et al. (2021) |
| Lack of policy and legal framework | | |
| Unrealistic political will or commitment | Policy | Monyei (2018) |
| | Policy | Bayramov and Marusyk |
| Improper use of subsidies | | (2019) |
| Donor dependency | | |
| | Policy | Jamil (2013) |
| | Policy | Ahlborg and Hammar |
| | | (2014) |

**Source: Designed by authors**

**Methodology**

This study examines the rural electrification challenges to overcome the energy trilemma and considers the different dimensions of sustainability. Therefore, approaches will be used to address the proposed and developed frameworks (specific and general). The general framework is the reference set of sustainable dimensions, which are generally considered as social, economic, and environmental. However, the environment is defined as the impact of the project on the local

environment and ecosystem presentation. While socioeconomic is the related social and economic development of communities as well as that ease security and maintenance of the system that will assist the organization or institution in decision making and link to the sustainable development of rural electrification.

The conceptual frameworks are developed in three different figures (Figure 1, Figure 2, and Figure 3) Figure 1 is referred to financing, investment, and sustainability. Figure 2 details requesting information from the rural population to access the acceptability of the program to be developed using a survey questionnaire. The research questionnaire uses Confirmatory Factor Analysis (CFA) under Structural Equation Modeling (SEM) to confirm the acceptability and sustainability relationship for sustainable development with the targeted population of the rural area.

**Data collection**

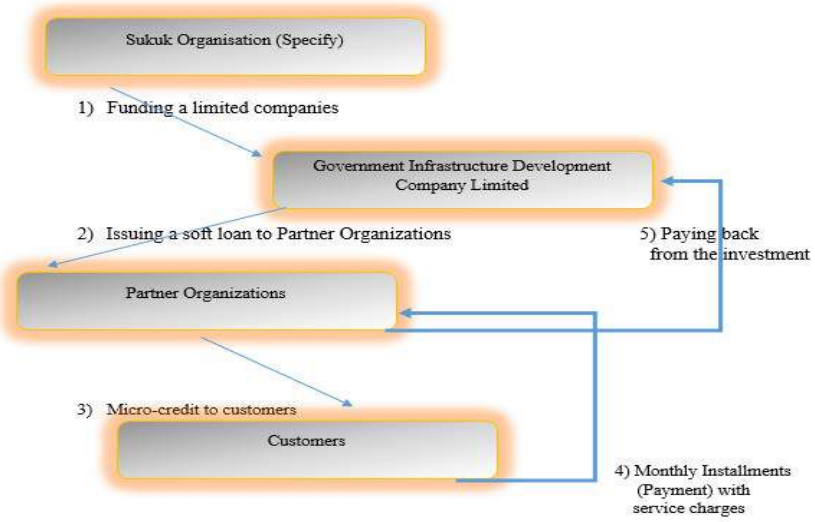
The data was gathered from rural communities. The study obtained data from rural individuals to avoid biased results. The total number of returned questionnaires was 400 for analysis, which is tactically considerable under Structural Equation Modeling based on Confirmatory Factor Analysis in identifying relationships and enhancing sustainable rural electrification. However, Structural Equation Modeling used a flexible and litheness model for conducting such test. Multiple predictions and variables criterion, model errors in measurement are employed for variable construct latent (Bisbe & Malagueño, 2015). SEM shields are indictors that reflect in constructs, which have been analyzed. Reliability and validity were also used to determine the consistency in the data. The composition reliability, Cronbach's alpha, Average Variance Extracted (AVE), and convergent discriminant validity were checked for accuracy of the research variables.

**Investment framework**

In Nigeria, 86 per cent of the urban population have access to electricity and 34 per cent of remote and rural areas have access to electricity, while 66 per cent lives in darkness. Even though electricity is accessible, but the rate of electricity is unreliable as inconsistent and stable (Pali, & Vadhera, 2020), whereby in 24 hours, they have access to electricity for only 7-8 hours. For the rural or remote areas that lack access in totality, this proposed research provides a solution with the help of Sukuk (Islamic capital market) to address the collaboration of sister's organisations that are ready to participate in the aforementioned. The programme will kick-off with a targeted group of lower-income earners in rural areas with lighting expenses of 1-2 US dollars per day (Bai, Alemu, Block, Headey & Masters, 2021), and to initially have some targeted number for the household installation.

Institutional Mechanism: The proposed project should have some stipulated numbers of a partner organisation. The government provides Sukuk funding and refinance the partners as loans and attached with some technical specification for the loan under *Mudarababa* or *Musharakah* financing. The institution should also be regulated by the central body of government where the solar technical specifications for equipment will be deployed by the government and the partner's organisation that take responsibility for installation and provide sufficient training to their members based on capacity building and performance.

Fig 1: Investment Framework




The main role of partners is to identify the areas with the potential customers, and offer a micro-credit, install the solar system, provide maintenance, monitoring, to ensure the availability of spare parts, identify a required appliance to be applied on system capacity for productive use, and organize training to the end-users and training the local technicians in other to create jobs to youths, local expertise, and ownership of the system, as the role of a partner organisation. Figure 1 shows the project implantation procedure while the other (POs) may have their procedure of delivery for better system usage and improve on reliability and quality of service to be rendered.

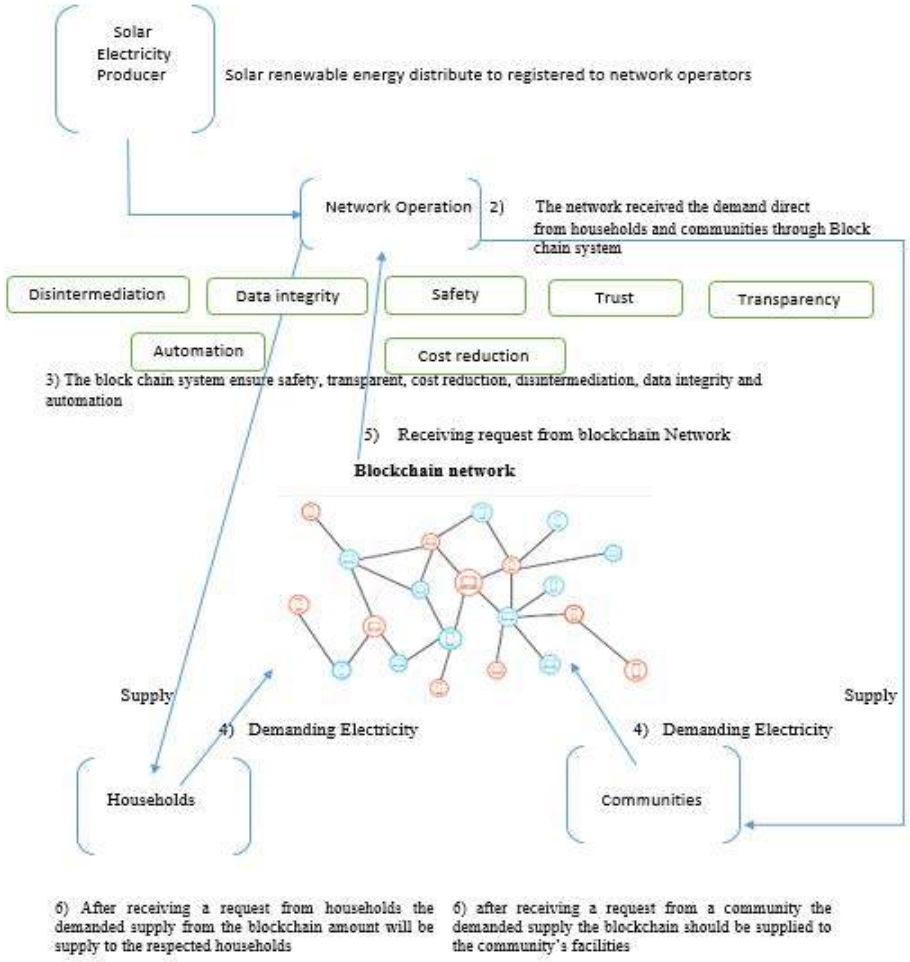
Financial Mechanism: Though Sukuk financing offers to partners organisation soft loan through *Murabahah* financing or diminishing *Musharakah* as the end-user own the equipment with an 8 per cent profit with a maturity period of 10 years. Subsequently, the Partner's Organisations provide credit to their end customers. As a customer must pay some percentage as a down payment of 10 or 15 per cent of the cost of the system and outstanding payment between the Partner's Organisations and customer or to be classified based on a monthly installment basis with a profit margin that includes maintainers if rendered.

Legal framework and Policy: The current energy policies do not create any obstruction, obstacle or hinder progress rather cannot address the entire need of the massive population of the country. The North-East, North-West, and North-Central have a very strong sunlight system where solar can be used and power households as new renewable energy in use and the national policy were already in place.

**Renewable Energy and Blockchain Technology**

Figure 2 shows the Technological areas of Distributed Energy Resources considered as the vast array of small-scale energy technologies owned by consumers such as pool pumps home batteries, smart appliances that communicate to each other and respond to signals from the grid, and will also have home energy management system that can coordinate and control energy use, in term of managing the voltage and predict supply and demand of the electricity network. The network will be attributed to three expected views of the electricity network, stronger, efficient and affordable as the blockchain technology was proposed to be used based on the needed demand and supply of power as indicated below.

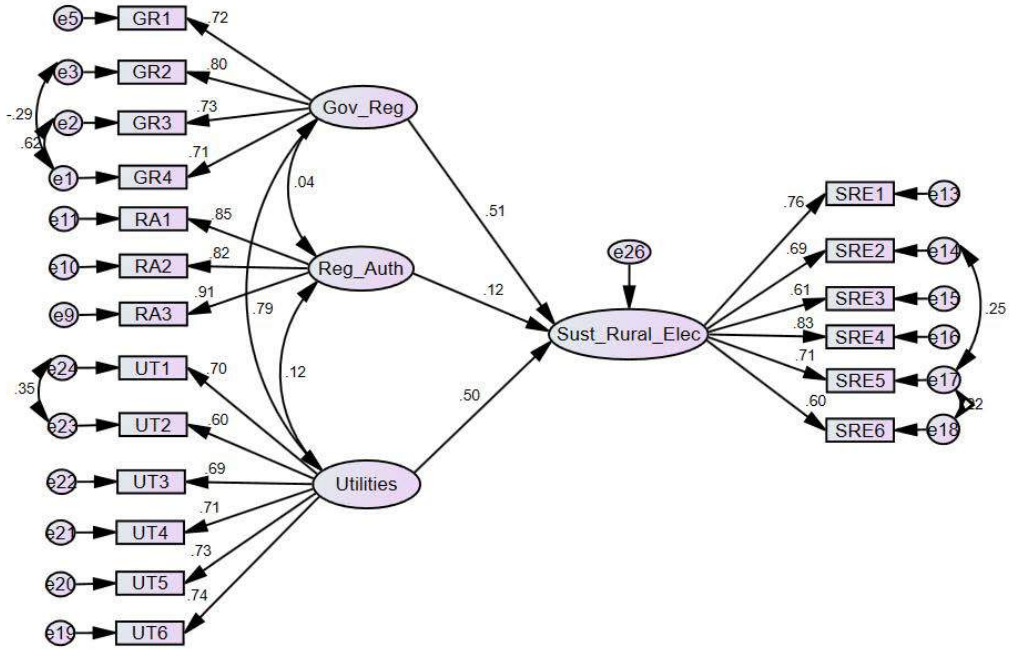
**Figure 2: Renewable Energy through Blockchain Technology decentralization**




**The Procedure**

The solar Electricity Producer sends the power electricity to network operation with a bridge of centralization of the disintermediation, proves the data integrity, the safety of information, trust the processes and transparency, automation and is less cost-effective. The demand and supply will be based on the needs of households and communities through blockchain discharge technology.

**Figure 3: Rural Perception**




**P-value**: 0.000 **GFI**: 0.878 **AGFI**: 0.835 **CMIN/DF**: 3.837
**IFI**: 0.913 **CFI**: 0.913 **RMSEA**: 0.084

**Table 4 Goodness of fit indices**

| Measures | Position | Authors | Suggestion |
|---|---|---|---|
| CMIN/DF | 3.837 Acceptable | Bantler (1990), Marsh and Hocevar (1985) | < 5.0 |
| GFI | 0.878 Satisfactory | Chau (1997), Grover (1993) | > 0.8 |
| AGFI | 0.835 Good | Byrne (2010) | > 0.8 |
| CFI | 0.913 Acceptable | Bentler (1990), Hatcher (1994) | > 0.9 |
| IFI | 0.913 Acceptable | Byrne (2010) | > 0.9 |
| RMSEA | 0.084 Good | Byrne (2001) | < 0.085 |

The latent variables and goodness of fit. The GFI indicates a satisfactory level at above 0.8, as recommended by (Grover 1993) and (Chau 1997). AGFI is above 0.8 (Bryne 2010). CFI also indicates a level of acceptance as above 0.9, while RMSEA is considered below the level of 0.85 (Bryne, 2001). The study indicates that the research model developed, confirmed, and has good overall goodness of fit as indicated above table. The path coefficient measurement shows positive results as indicated above.

**Table 5 Hypotheses test**

| Hypothesis | Estimate | SE | CR | P | Decision |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| GR -> SRE | 0.509 | 0.051 | 6.755 | 0.000 | Supported H1 |
| GA -> SRE | 0.123 | 0.020 | 4.007 | 0.000 | Supported H2 |
| UT -> SRE | 0.502 | 0.074 | 6.926 | 0.000 | Supported H3 |

**H1) Government Regulation (GR) significantly enhance Sustainable Rural Electrification (SRE)**

The critical value and p-value of Government Regulation (GR) in predicting Sustainable Rural Electrification (SRE), the probability of getting a critical ratio as large as 6.755 in absolute value is less than 0.000. In other words, the regression weight for GR in the prediction of Sustainable Rural Electrification is significantly different from zero at the 0.000 level (two-tailed) and supported hypothesis 1 (H1) with a standardized Beta of 0.509, and showed the positive relationship.

**H2) Regulatory Authorities (RA) significantly enhance Sustainable Rural Electrification (SRE)**

The probability of getting a critical ratio as large as 4.007 in absolute value is 0.000. In other words, the regression weight for RA in the prediction of Sustainable Rural Electrification is significantly different from zero at the 0.000 level (two-tailed) and supported hypothesis 2 (H2), and indicated a positive relationship.

**H3) Utilities (UT) significantly enhance Sustainability Rural Electrification (SRE)**

The critical value and p-value of Utilities (UT) in predicting Sustainable Rural Electrification (SRE) are 6.926 and 0.00, respectively. Thus, explaining the probability of getting a critical ratio as large as 6.926 in absolute value is 0.000. In other words, the regression weight for UT in the prediction of Sustainable Rural Electrification is significantly different from zero at the 0.000 level (two-tailed) and supported hypothesis 3 (H3), and indicates the standardized Beta was 0.074 which indicated a positive relationship.

**Table 6 Reliability and validity**

| Construct item | Initial loading | CR | AVE | Cronbach alpha |
|---|---|---|---|---|
| Government Regulation (GR) | | **0.700** | **0.740** | **0.844** |
| | GR1 0.720 | | | |
| | GR2 0.797 | | | |
| | GR3 0.730 | | | |
| | GR4 0.715 | | | |
| | ~~GR5 0.489~~ low loading | | | |
| | ~~GR6 0.409~~ low loading | | | |
| Regulatory Authority (RA) | | **0.701** | **0.860** | **0.855** |
| | RA1 0.851 | | | |
| | RA2 0.823 | | | |
| | RA3 0.906 | | | |
| | ~~RA4 0.389~~ low loading | | | |
| | ~~RA5 0.498~~ low loading | | | |
| Utilities Services (UT) | | | **0.887** | **0.721** **0.850** |
| | UT1 0.696 | | | |
| | UT2 0.602 | | | |
| | UT3 0.688 | | | |
| | UT4 0.707 | | | |

| | | | | |
|---|---|---|---|---|
| | UT5 0.730 | | | |
| | UT6 0.742 | | | |
| Sustainable Rural Electrification (SRE) | | **0.871** | **0.701** | **0.861** |
| | SRE1 0.763 | | | |
| | SRE2 0.687 | | | |
| | SRE3 0.613 | | | |
| | SRE4 0.835 | | | |
| | SRE5 0.711 | | | |
| | SRE6 0.597 | | | |

*Composite Reliability (CR) ** Average Variance Extraction

All standard factor loadings must meet the minimum of 0.5, and such loadings indicate positive loadings. Any low loading variable below the level 0.5 was removed such as GR5, GR6, RA4 and RA5, which were poorly loaded and removed as indicated by Hair et al. (2010) and Bryne (2010). The reliability and validity were also used in the above table to indicate and represent each group as defined in the above Composite Reliability (CR) columns. Average Variance Extracted (AVE) and Cronbach's Alpha were considered significant and good loadings and is above the cut-off point.

**Table 7 Discriminant Validity for Measurement Model**

| **Variables** | **GR** | **RA** | **UT** | **SRE** |
|---|---|---|---|---|
| Government Regulation (GR) | | **0.430** | | |
| Regulatory Authority (RA) | | 0.040 | **0.463** | |
| Utilities Services (UT) | 0.791 | 0.123 | **0.424** | |
| Sustainable Rural Electrification (SRE) | 0.455 | 0.205 | 0.459 | **0.418** |

"The Above Diagonals represent the square root of the average variance extracted while the other entries represent the square correlations"

The inter-correlation shown between the four (4) constructs indicate the range between 0.040 to 0.791, which were below the recommended threshold of 0.85 (Kline 2005). However, the correlations were less than the square root of the average variance, which indicates good discriminant validity as extracted by indicators amongst these factors (Kline, 2005). Moreover, the goodness of fit data, discriminant validity, and convergent validity of the measurement model, which concluded that modified model measurement is scale assessment of constructs and their relevant items and valid reliability. Therefore, the above results indicate the masses acceptability of the government regulation, the regulatory authorities as POs of the respective organisation is highly accepted for the potential renewable energy. Sequentially, affordable utility services are also considered. All these factors enhance the sustainability of rural electrification.

**Discussion**

The initial intention of using Sovereign Sukuk is created based on ethical funding that is gingered through a financial instrument that is a religious-based principle of Islamic funding infrastructure projects. The privileged and opportunity to develop and invest in a real project promote Sukuk that creates enthusiasm and encourage real sector development through financing sources from

the Islamic capital market. However, as for project financing, the Government passed the regulation on Project Finance with Sovereign Sharia Securities Issuance. Therefore, the regulation was set among others procedures and scope for the project initiated by Agency and Ministry to be funded directly by Sukuk issuance. Based on the Sharia point of view, the Government engaged and worked closely with the Council of Ulama or the National Sharia Board of Nigeria. There are several choices of Islamic finance contract to create Sukuk for project finance. Further, the Government's projects will strictly be funded by Sukuk issuance, whereby the Sovereign Sharia Securities may also be perceived based on Ijarah Asset to be leased. Therefore, the Ijarah or leasing contract specification has to be determined and some exist at the time of the contract or other Islamic contract that suits the Sovereign Sukuk. The Sukuk is considered as alternative funding to finance the Nigerian Power Plant. Such concept access is based on the data and feasibility study from 30 communities, from the basic financial assumptions.

A decentralized electricity requires the exchange proposal of electricity between public and private parties through blockchain technology that developed and promoted information technology to realize and accompany the new vision of transparency and fair accountability. On a blockchain-based, the market and transactions processed is settled without the mediation of a third party (Mengelkamp et al., 2017). Despite the ongoing development of blockchain, many scholars' critics the value of employing blockchain technology in this context. Indeed, many existing publications are quite vague about the exact setup of their proposed systems, the market design choices, and in particular the value of the blockchain in this context. There is still little understanding of the economic impact and consumer engagement (Tiefenbeck, 2017) in the sociotechnical systems and markets that are being created (Beck et al., 2017; Malinova, 2016). The successful peer-to-peer electricity market is in line with an overall objective to promote sustainability which develops social incentives for the consumer of electricity. Sequentially, the availability of renewable energy should reflect the price and local communities or households. Thus, determined and distributes within the intended communities to achieve the overall project.

Government regulation in developing countries and the concept of Renewable Energy authorities are relatively new. The main role of the agencies is to act on behalf of the government in organizing, planning, and financing Renewable Energy activities. Thus, this shows that the agents must manage and maintain the resources to help build the capacities for rural electrification to promote rural electrification plans in line with communities and rural developments. Rural electrification must be guided by government policy, regulatory body, and utilities for sustainability. Renewable Energy authorities must work with regulators to give appropriate structures, tariffs, and practical subsidies application in the rural areas. It is the role of Renewable Energy agents to enhance development and facilitate appropriate application technology through training and development skill relevancy. While the main issue for Renewable Energy is to improve financing in the field of Sukuk financing. Further, authorities must provide ways and initials to involve financial institutions to support the policy framework and supportive policies. Moreover, Renewable Energy authorities must collaborate and have synergy with standard bodies and regulators to ensure standard compliance.

**Regulatory authority:** Companies regulate their conduct based on environmental competitiveness, regulators are put in place to regulate the activities and players that monopolize in their respective areas of coverage. The regulators balance between the utilities and Renewable Energy to ensure transparent regulatory systems, which consist of tariffs and fee connections for new services to align the performance standards. The regulators may consistently develop a system that enhances and increase the investment capacity of the electricity distribution and

generation system, and also encourage decentralization through using blockchain technology which can simply be used by local communities. However, regulators ensure work with Renewable Energy authorities and subsidies are captured and effectively utilized to vulnerable or those that cannot afford the services in the rural communities.

Electricity supply to remote areas largely depends on the national grid or monopoly. It is, therefore, the responsibility of regulators to ensure rural customers operates and fair system and receive quality services and pay fair prices through effective regulation. Therefore, the case of decentralization of electricity operators must be regulated due to the monopoly system of operation, and regulators authority should ensure the acceptability standard of services to remote or rural consumers to ensure services integrate policy based on the transparent and investor confidence. In addition, regulators must protect and promote customers and act on their concerns and ensure the customer's participation in regulatory processes.

**Utility and affordability:** Market reform changes the narration of utility companies structured towards each other based on the customers' and government's perception. The company may enter and exit the market at all times. Utility companies play a significant role in renewable energy through operational and developmental rural electrification by transmitting electricity to remote or rural areas. Utilities directly or indirectly generate and enable access to remote areas. However, the responsibilities for both public and private utilities in the field of Renewable Energy are to distribute, transmit and supply electricity to remote or rural customers; thus, to innovate and possibly develop and enhance at least cost and affordability of Renewable Energy based on technologies. Utilities play a significant role in personnel training and increasing technical skills to manage rural electricity supply systems where the fund generates and remits government levies for renewable Energy.

**Conclusion**

The development of renewable energy projects through Sukuk is very critical and should be prioritized, and considered as one of the alternatives of funding projects in Nigeria. This instrument is prioritized by the Government and classified as a debt financing tool for productive spending. Therefore, majority of the rural electrification programme has been proposed where some were implemented around global, considering the objectives and sustainability dimensions for long-term development. However, the methodology and the implementation process differ, whereby the paper proposes another new dimension on three proposed methods based on funding, implementation, and perception of rural communities. Such plans at the regional and international level which enhance the energy trilemma to overcome hurdles and promote Renewable Energy sustainability and distinguishing three categories of economic, technology, and socio perception based on the acceptability of the newly proposed research for rural electrification for benefit related and economics sustainable development.

The proposed three methodologies of Renewable Energy are based on national policy of remote or rural electrification. The proposed framework generates a portfolio within a national framework. The framework policy specifically estimates the useful need for investment at national and local level between organisations to end-users. Therefore, the projected frameworks are decentralized using technology systems through blockchain in an affordable and reliable system in terms of usage and affordability in terms of cost. The preparation of the three methods proposed system, and lessons indicate in several parts of the world from 2005 to 2013, different communities around the world estimated 142,000 people benefitted such system using Renewable Energy through wind and solar. While in Nigeria, North-East, North-West and North-

Central regions may accept the solar system as recommended, and South-East, South-West and South-South regions may use hydro and gas as their level of sunny in South which is low compared to other Northern regions of the country.

The final stages which identified some targeted population of the programme and evaluated their perception based on the proposed Figure 1, and Figure 2 is measuring acceptability and sustainability impact on the proposed framework to generate and distribute electricity through technologies means of blockchain.
The proposed research methods are North-East, North-West and North-Central applied to three (3) regions of the rural electrification accessing household and communities' perception concentrated for a better outcome and address rural electrification in the country. Therefore, the planned proposal can be used everywhere and will consider the sustainability of rural electrification programmes with long-term benefits and commitment based on institutions, stakeholders and technologies for accomplishing access to Renewable Energy.

**The implication for policy and strategy**

The study findings developed a strategy and policy planning that needs to be considered for rural households and communities' access to electricity in Nigeria. The government and organizational intermediate should consider three methods based on the three figures proposed; Sukuk investment, Technological control through blockchain and controlling access to electricity. The study's finding shows a positive and significant relationship between the Government Regulation (GR), Regulatory Authorities (RA), and Affordable Utilities (UT) towards Sustainability Rural Electrification in Nigeria. Masses can have access to electricity and should make proper screening for better activities and services.

**Limitation of the study**

There are limited areas covered and did not include the entire regions in the country and all isolated communities, which are mainly from the Northern part of Nigeria, that was affected due to financial constraints do not permit the extent of the research outside the three regions, North-East, North-West, and North-Central. The research may extend wider in the future to increase the generalization of the country.

## References

Abdulrahman, M. D., Gunasekaran, A., & Subramanian, N. (2014). Critical barriers in implementing reverse logistics in the Chinese manufacturing sectors. *International Journal of Production Economics*, *147* (1), 460-471.

Afolabi, A. (2015). The effect of entrepreneurship on economy growth and development in Nigeria. *The Effect of Entrepreneurship on Economy Growth and Development in Nigeria*, *3*(2), 1-17.

Ahlborg, H., & Hammar, L. (2014). Drivers and barriers to rural electrification in Tanzania and Mozambique–Grid-extension, off-grid, and renewable energy technologies. *Renewable Energy*, *61 (1)*, 117-124.

Aikman, S., & Rao, N. (2012). Gender equality and girls' education: Investigating frameworks, disjunctures and meanings of quality education. *Theory and Research in Education*, *10*(3), 211-228.

Aikman, S., & Rao, N. (2012). Gender equality and girls' education: Investigating frameworks, disjunctures and meanings of quality education. *Theory and Research in Education*, *10*(3), 211-228.

Alla, B., Agaev, Y., & Torkunova, J. (2018). China—CELAC: new trends in the economic cooperation. *Latin America*, 7(1), 32-46.

Almeshqab, F., & Ustun, T. S. (2019). Lessons learned from rural electrification initiatives in developing countries: Insights for technical, social, financial and public policy aspects. *Renewable and Sustainable Energy Reviews*, *102 (1)*, 35-53.

Ayadi, F. O. (2012). Community banks, poverty alleviation & rural development in Nigeria: a re-orientation. *African Journal of Business and Economic Research*, *7*(23), 171-192.

Bai, Y., Alemu, R., Block, S. A., Headey, D., & Masters, W. A. (2021). Cost and affordability of nutritious diets at retail prices: Evidence from 177 countries. *Food policy*, *99 (1)*, 101-983.

Bayramov, A., & Marusyk, Y. (2019). Ukraine's unfinished natural gas and electricity reforms: one step forward, two steps back. *Eurasian Geography and Economics*, *60* (1), 73-96.

Bhattacharyya, S. C., & Palit, D. (2016). Mini-grid based off-grid electrification to enhance electricity access in developing countries: What policies may be required?. *Energy Policy*, *94 (1)*, 166-178.

Candelise, C., Saccone, D., & Vallino, E. (2021). An empirical assessment of the effects of electricity access on food security. *World Development*, *141 (1)*, 105-390.

Chaurey, A., & Kandpal, T. C. (2010). Assessment and evaluation of PV based decentralized rural electrification: An overview. *Renewable and Sustainable Energy Reviews*, *14*(8), 2266-2278.

Falcón-Roque, E. J., Marcos Martín, F., Pascual Castaño, C., Domínguez- Dafauce, L. C., & Bastante Flores, F. J. (2017). Energy planning model with renewable energy using optimization multicriteria techniques for isolated rural communities: Cajamarca province, Peru. *Journal of Renewable and Sustainable Energy*, *9*(6), 065-903.

Heck, N., Smith, C., & Hittinger, E. (2016). A Monte Carlo approach to integrating uncertainty into the levelized cost of electricity. *The Electricity Journal*, *29*(3), 21-30.

Jamil, F. (2013). On the electricity shortage, price and electricity theft nexus. *Energy policy*, *54*(1) 267-272.

Jebaraj, S., & Iniyan, S. (2006). A review of energy models. *Renewable and sustainable energy reviews*, *10*(4), 281-311.

Loayza, N. V., & Raddatz, C. (2010). The composition of growth matters for poverty alleviation. *Journal of development economics*, *93*(1), 137-151.

Malamud, A., & Gardini, G. L. (2012). Has regionalism peaked? The Latin American quagmire and its lessons. *The international spectator*, 47(1), 116-133.

Mitra, I. (2009). *Optimum utilization of renewable energy for electrification of small islands in developing countries*. kassel university press GmbH.

Monyei, C. G., Adewumi, A. O., Obolo, M. O., & Sajou, B. (2018). Nigeria's energy poverty: Insights and implications for smart policies and framework towards a smart Nigeria electricity network. *Renewable and Sustainable Energy Reviews*, 81(1), 1582-1601.

Nilsson, M., Lucas, P., & Yoshida, T. (2013). Towards an integrated framework for SDGs: Ultimate and enabling goals for the case of energy. *Sustainability*, *5*(10), 4124-4151.

Oyedepo, S. O. (2012). Energy and sustainable development in Nigeria: the way forward. *Energy, Sustainability and Society*, 2(1), 1-17.

Pali, B. S., & Vadhera, S. (2020). Uninterrupted sustainable power generation at constant voltage using solar photovoltaic with pumped storage. *Sustainable Energy Technologies and Assessments*, 42(1), 100-890.

Pereira, H. M., Leadley, P. W., Proença, V., Alkemade, R., Scharlemann, J. P., Fernandez-Manjarrés, J. F., ... & Walpole, M. (2010). Scenarios for global biodiversity in the 21st century. *Science*, *330*(6010), 1496-1501.

Pereira, M. G., Sena, J. A., Freitas, M. A. V., & Da Silva, N. F. (2011). Evaluation of the impact of access to electricity: A comparative analysis of South Africa, China, India and Brazil. *Renewable and Sustainable Energy Reviews*, *15*(3), 1427-1441.

Phadke, A., Park, W. Y., & Abhyankar, N. (2019). Providing reliable and financially sustainable electricity access in India using super-efficient appliances. *Energy Policy*, *132 (1)*, 1163-1175.

Shyu, C. W. (2012). Rural electrification program with renewable energy sources: An analysis of China's Township Electrification Program. *Energy policy*, *51(1)*, 842-853.

Sinaga, R., Simangunsong, B. C., Liebman, A., & Tambunan, A. H. (2019). Analysis of barriers in supplying electricity using interpretativestructural modeling. *Energy Strategy Reviews*, *25 (1)*, 11-17.

Singh, S. P., & Sharma, S. C. (2017). A particle swarm optimization approach for energy efficient clustering in wireless sensor networks. *International Journal of Intelligent Systems and Applications*, *11*(6), 66.

Slough, T., Urpelainen, J., & Yang, J. (2015). Light for all? Evaluating Brazil's rural electrification progress, 2000–2010. *Energy Policy*, *86 (1)*, 315-327.

Talavera, D. L., Pérez-Higueras, P., Ruíz-Arias, J. A., & Fernández, E. F. (2015). Levelised cost of electricity in high concentrated photovoltaic grid connected systems: spatial analysis of Spain. *Applied energy*, *151 (1)*, 49-59.

Williams, N. J., Jaramillo, P., Taneja, J., & Ustun, T. S. (2015). Enabling private sector investment in microgrid-based rural electrification in developing countries: A review. *Renewable and Sustainable Energy Reviews*, *52 (1)*, 1268-1281.

JOMAES

Journal of Management and Economic Studies

2022, 4(1): 47-58 DOI: 10.26677/TR1010.2022.958

Journal Homepage: https://www.jomaes.org

# Selection of Solder Paste Inspection Machines by Multi-Criteria Decision Analysis

**İpek DEVECİ KOCAKOÇ**
Dokuz Eylül University, Faculty of Economics and Administrative Sciences, Turkey.
www.orcid.org/0000-0001-9155-8269
ipek.deveci@deu.edu.tr

**Gökçe BAYSAL TÜRKÖLMEZ**
Dokuz Eylül University, Faculty of Economics and Administrative Sciences, Turkey.
www.orcid.org/0000-0001-9185-3356
gokce.baysal@deu.edu.tr

**Abstract**

One of the most important factors to give an inspection automation decision is the precision of measurements taken by the inspection machine. This paper aims to provide help in the selection of an automatic optical inspection (AOI) machine for a printed circuit board (PCB) assembly line of an electronics manufacturer. Since the visual inspection of soldered surfaces on a PCB is a crucial step, AOI machines bring great speed and accuracy to the inspection process. The main goal is to find the best automatic inspection machine alternative among the three AOI machine offerings according to nine selection criteria by integrating coefficient of variation statistic with TOPSIS and VIKOR, which are well-known multicriteria decision analysis methods. For this purpose, three different brands of AOI machines have been tested for the same PCBs, with 10 different components. After calculation of TOPSIS and VIKOR rank scores, the coefficient of variation of rank scores for all components is obtained and the selection of the AOI machine is finalized.

**Keywords:** inspection machine selection, PCB assembly line, multi-criteria decision making, TOPSIS, VIKOR, coefficient of variation.

## INTRODUCTION

Quality improvement and cost reduction is a must in today's highly competitive electronics industry. Component sizes continue to shrink, and Printed Circuit Boards (PCB's) are becoming increasingly complex, as more functions are crammed into mobile phones, PCs, portable media players, and TVs. In these complex structures, a lot of different kinds of errors and defects occur and they avoid working electronic devices properly. Gunn and Reis (2001) recorded that about 50% of all electronic assembly errors and 65% of SMT-only defects have been correlated with solder paste printing and solder joint details over the past two years. Surface-mount (SMT)

technology is often a method of manufacturing electronic circuits where the components are mounted or positioned directly on the computer circuit board surface (PCBs). As it has either smaller leads or no leads at all, an SMT component is typically smaller than its through-hole counterpart. (Wikipedia1). Therefore, inspections are required in various phases in the process of assembling PCBs. These studies have shown that successful and thorough inspection of paste immediately after screen printing is important to ensure high yields, minimize rework/retest and reduce overall scrap costs. (Gunn and Reis, 2001). An inspection procedure is capable of partially identifying the defects created, preventing them from being processed further downstream and, more crucially, from succeeding in customers (Rezaei-Malek, 2018).

A critical phase in the production process is visual verification of soldered surfaces (Ray, R. 1988). Generally, two kinds of inspection methods are used by electronic companies: Traditional Manual Vision Inspection and Automatic Optical Inspection (AOI)/Machine Vision.

Traditional Manual Vision Inspection is a procedure in which human professionals undertake visual inspection and quality control (Malamas et al., 2003). It is a labor-intensive process and humans can make subjective judgments affecting the quality of the product. Traditional manual vision inspection simply cannot achieve the level of quality control and cost reduction required by today's markets. Meanwhile, computer developments in terms of high-speed, massive, low-cost memory have resulted in better and cheaper image processing equipment. There is also a chance to introduce and incorporate an automatic PCB inspection system to eliminate the subjective elements of manual inspection (Dave et al., 2016).

Automatic Optical Inspection (AOI) - Machine Vision consists of capturing an image (a snapshot in time), transforming the image to digital information, and applying processing algorithms to extract helpful image information for pattern recognition, part inspection, or part positioning and orientation requirements. The use of machine vision technologies can increase PCB product quality while lowering production costs (Guo and Guan, 2011).

There are a lot of hidden benefits and costs behind "implementation of AOI":

• Advantage against Manual Vision Inspection: AOI is said to cover more than 95% of faults while MVI has only 60-70% coverage. The machinery works 24H a day 7 days a week consistently, providing high throughput, high speed, and high accuracy.

• Cost Performance: Replacing operators with AOI equipment will reduce the cost of operators, but other hidden costs can be reduced. For instance, the time and cost of operators to be trained cause a loss of profit for the company. As AOI can be used to prevent defects at the earlier stage of production, rework time, and rework costs are reduced. Prevention of field failure contributes to sustained customer reputation and reduction of repair costs.

• SPC and Traceability: AOI generates various statistical data of each defect, which can then be analyzed to improve production quality. By understanding current process trends in real-time, the process can be controlled before faults are produced. SPC data of all boards can be stored as an insurance measure for quality issues.

Overall, implementing AOI will achieve yield improvement, cost reduction, and improved quality assurance and control.

Because of the high rate of defects, solder paste inspection is examined in this study. A leading electronics company wants to select a Solder Paste Inspection (SPI) machine for inspecting assembled PCBs among 3 major suppliers. They are analyzed according to their measuring performances and tests performed for bending, repeatability, rotation, and r-pass rate. Because

of the structure of the problem, the multi-criteria approach to help the company choose the best machine is utilized in this study.

## PCB ASSEMBLY LINE AND INSPECTION OF PCBS

Electronic soldering joins two metallic wires/ connectors/ pins of a circuit. The soldering happens when a metallic alloy, called solder, is melted down on the joint due to soldering iron's heat, and bonds the target conductors together when the solder cools down and solidifies. Machine soldering happens by driving component-populated printed circuit board (PCB) through molten solder (drag and wave soldering), or by applying solder paste to the contacts and melt the paste by heat (reflow soldering). A machine soldering needs the industrial process and it is for mass production. There are different methods for PCB inspection and AOI is one of them. AOI is used to examine solder quality as well as pad and trace connections (Tempoautomation, 2018).

As stated by Anderson (2018), "AOI finds defects in both bare PC boards and assemblies. With small components, these defects are often invisible to the eye. The AOI process finds uneven soldering, tombstones, missing components, and misaligned parts within the PCB assembly process. The AOI machine takes a series of high-resolution photos and stitches them together using the software."

2D inspection detects lands, silk points, via holes, and traces to recognize precise solder height. Also, it measures the solder's deposition shape. It then calculates the solder area, height, and volume by 3D Phase shape inspection. For a detailed literature review on AOI for PCBs, Wang et al. (2017) can be referred to.

There exist three kinds of inspection points in a PCB production line. These are "Solder Paste Inspection", "Pre Reflow Inspection" and "Post Reflow Inspection" (Figure 1). AOI appliances have a unique name in each location. Solder Paste Inspection (SPI, also known as Post-Printing Inspection), Automatic Placement Inspection (API, also known as Post-Placement Inspection), and Post-Soldering Inspection (PSI) are three of them. Universal AOI systems (UAOI) are AOI systems that can check each production sequence (Janóczki et al., 2013).

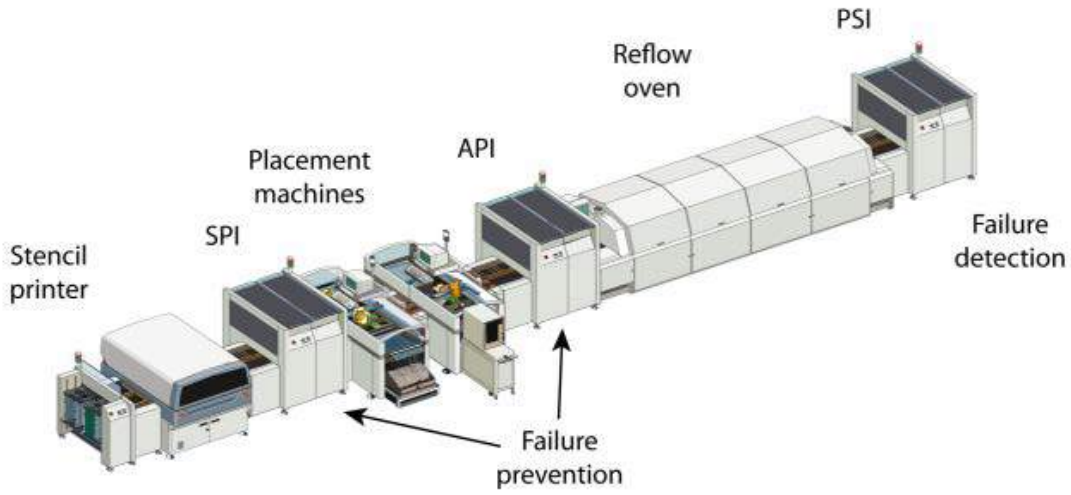



**Figure 1.** Possibilities for AOI placement in an SMT line (Janóczki et al., 2013).

There are not enough studies on the "automatic optical inspection system" selection problem in the literature. Since AOI is a part of the automatization process, AOI systems can be considered similar to robots, so we based our literature review on robot selection problems. Parameshwaran et al. (2015) composed a very detailed literature review on robot selection up to 2014. They

presented tables listing the techniques used and selection criteria. In the following table, we extend this literature review including articles from 2015 to 2019.

**Table 1.** Extension of literature review

| Techniques/tools used | Authors | Publication year | Selection criteria |
|---|---|---|---|
| Fuzzy Delphi Method (FDM), Fuzzy Analytical Hierarchical Process (FAHP), Fuzzy modified TOPSIS, Fuzzy VIKOR and Brown–Gibson model | Parameshwaran et al. | 2015 | 22 criteria including both objective (i.e. Equipment cost, load capacity, repeatability) and subjective (i.e.stability, compliance, stability) factors. |
| PROMETHEE II | Sen et al. | 2015 | Load capacity, repeatability, velocity, cost |
| MCDM- interval type-2 fuzzy sets | Ghorabaee | 2016 | Inconsistency with infrastructure, Man-machine interface, Programming flexibility, Vendor's service contract, Supporting channel partner's performance, Compliance, Stability |
| Interval-Valued Hesitant Fuzzy-Distance-Based Group Decision (IVHF-DBGD) | Gitinavard et al. | 2016 | Man-machine interface, Programming flexibility, Vendor's service contract, Load capacity, Positioning accuracy, Purchase cost |
| integrated model based on hesitant 2-tuple linguistic term sets and an extended QUALIFLEX approach | Xue et al. | 2016 | Man-machine interface, Programming flexibility, Vendor's service contract, Purchase cost, Load capacity, Positioning accuracy. |
| Fuzzy PROMETHEE | Sen et al. | 2016b | Load capacity, repeatability, maximum tip speed, memory capacity, manipulator reach, man-machine interface, programming flexibility, vendor's service contract, positioning accuracy, safety, environmental performance, reliability, maintainability |
| Iterative MCDM- TODIM | Sen et al. | 2016a | load capacity, repeatability, maximum tip speed, memory capacity, manipulator reach |
| Fuzzy VIKOR | Bahadır and Büyüközkan | 2016 | Total Cost, Velocity, Load Capacity, Operating Time, Functionality |
| Weighted sum method (WSM), weighted product method (WPM), | Karande et al. | 2016 | Load capacity, maximum tip speed, repeatability, memory capacity, manipulator reach; cost, handling |

| | | | |
|---|---|---|---|
| weighted aggregated sum product assessment (WASPAS) method, multi-objective optimization based on ratio analysis and reference point approach (MOORA) method, and multiplicative form of MOORA method (MULTIMOORA) | | | coefficient, load capacity, repeatability, velocity |
| Weighted aggregated sum product assessment method (WASPAS) | Mathew et al. | 2017 | Load capacity, maximum tip speed, repeatability, memory capacity, manipulator reach |
| AHP | Breaz et al. | 2017 | Load capacity, reach, weight, repeatability, power consumption, dexterity, service |
| Fuzzy extended VIKOR | Zhou et al. | 2018 | Total ownership of cost, Velocity or speed of travel, Load capacity, Repeatability, Positioning accuracy, Programming flexibility, Man-machine interface |

## THEORETICAL BACKGROUND FOR METHODS

Robot selection may be viewed as a dynamic set of decision-making challenges that necessitate the consideration of various alternative providers with multiple quantitative and qualitative criteria (You, 2015). Indeed, selecting an appropriate robot in pursuit of a certain sector of operation is a demanding task that, if failed, can have a negative impact on an organization's competitiveness (in terms of productivity) (Sen, 2016a).

There are more than two possibilities and more than one decision criterion in this study to determine the suitable AOI system. Multi-criteria decision-making procedures are appropriate for the problem's structure. As a result, we applied two multi-criteria decision-making methodologies, TOPSIS and VIKOR, in an innovative way to analyze AOI systems. Both methods rely on an aggregating concept that indicates closeness to the reference location (s). They presume that there is an output matrix created by assessing all possibilities in terms of each criterion. In solution, both strategies provide a ranking list.

### TOPSIS Method

TOPSIS (Technique for order preference by similarity to an ideal solution), created by Hwang and Yoon in 1981, gives a ranking list based on choice problem criteria. This technique provides two reference points in the solution algorithm: ideal and negative-ideal solutions. The primary notion is that the chosen option should be the furthest away from the perfect solution and the furthest away from the negative ideal solution. The distance is an n-dimensional Euclidean distance (Opricovic and Tzeng, 2004). TOPSIS employs vector normalization, and the normalized value may represent distinct evaluation units of a certain criteria. The highest-ranked alternative by TOPSIS is the best in terms of the ranking index, but this does not always imply that it is the closest to the optimal solution (Tzeng et al. 2005).

TOPSIS has the following steps (Jahanshahloo et al., 2006):

1. Make a decision matrix that is normalized. The normalized value $n_{ij}$ is computed as follows:
   $n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}, i = 1, \dots, m, \ j = 1, \dots, n.$
2. $v_{ij}$ is the weighted normalized decision matrix.:
   $v_{ij} = w_j n_{ij}, \ i = 1, \dots, m, \ j = 1, \dots, n$, where $w_j$ is the weight of the ith criterion, and $\sum_{j=1}^{n} w_j = 1$.
3. Identify the positive and negative ideal solutions.
   $A^+ = \{v_1^+, \dots, v_n^+\} = \left\{\left(\max_j v_{ij} \,|i \in I\right), \left(\min_j v_{ij} \,|i \in J\right)\right\},$
   $A^- = \{v_1^-, \dots, v_n^-\} = \left\{\left(\min_j v_{ij} \,|i \in I\right), \left(\max_j v_{ij} \,|i \in J\right)\right\},$

   where I is associated with benefit criteria, and J is associated with cost criteria.
4. Using the n-dimensional Euclidean distance, compute the separation measures. The distance between each alternative and the optimal answer is denoted as
   $d_i^+ = \left\{\sum_{j=1}^{n} \left(v_{ij} - v_j^+\right)^2\right\}^{1/2}, i = 1, \dots, m,$

   Similarly, the separation from the negative ideal solution is given as

   $d_i^- = \left\{\sum_{j=1}^{n} \left(v_{ij} - v_j^-\right)^2\right\}^{1/2}, \ i = 1, \dots, m,$
5. Calculate the relative closeness to the ideal solution. The relative closeness of the alternative $A_i$ with respect to $A^+$ is defined as $R_i = d_i^-/(d_i^+ + d_i^-)$, $i = 1, \dots, m$. Since $d_i^- \geq 0$ and $d_i^+ \geq 0$, then, clearly, $R_i \in [0,1]$.

6. Sort your preferences in descending order. We may use this index to rank options in decreasing order.

**VIKOR Method**

VIKOR (Vise Kriterijumska Optimizacija I Kompromisno Resenje) calculates the compromise ranking-list, compromise solution, and weight stability intervals for preference stability of the compromise solution achieved with the initial (provided) weights. In the context of competing criteria, this strategy focuses on ranking and selecting among a group of possibilities (Opricovic and Tzeng, 2004). As the ideal solution, there is just one reference point. The Multicriteria ranking index is based on a specific measure of proximity to the ideal solution, and this technique suggests a compromise alternative with a rate of benefit. Linear normalization is used, and the normalized value is independent of the criterion's evaluation unit. It adds an aggregating function that represents the distance from the optimal answer. This rating index is an amalgamation of all criteria, their relative significance, and a balance of overall and individual happiness. (2010) (Sanayei et al.) The option with the greatest VIKOR rating is the closest to the perfect solution. The Lp-metric, which is employed in the compromise programming approach, is used to build the multi-criteria merit for compromise ranking (Zeleny, 1982).

$$L_{pj} = \left\{\sum_{i=1}^{n} \left[w_i (f_i^* - f_{ij})/(f_i^* - f_i^-)\right]^p\right\}^{1/p}, \ 1 \leq p \leq \infty; j = 1,2, \dots, J.$$

The following stages constitute the compromise ranking algorithm VIKOR (Opricovic and Tzeng, 2007):

1. Determine the best $f_i^*$ and the worst $f_i^-$ values for all criterion functions, i=1,2,…,n.
2. Compute the values $S_j$ and $R_j$, $j = 1,2, \dots, J$, by the relations
   $S_j = \sum_{i=1}^{n} w_i(f_i^* - f_{ij})/(f_i^* - f_i^-)$

   $R_j = \max_i[w_i(f_i^* - f_{ij})/(f_i^* - f_i^-)]$

where $w_i$ , i=1,2,…,n are the weights of criteria according to their relative importance.

3. Calculate values $Q_j, j = 1,2, \dots, J$ by the relation
   $Q_j = \frac{v(S_j - S^*)}{S^- - S^*} + \frac{(1-v)(R_j - R^*)}{R^- - R^*}$

where $S^* = \min_j S_j$, $S^- = \max_j S_j$ , $R^* = \min_j R_j$ , $R^- = \max_j R_j$ , and v is introduced as the weight of strategy of the majority of criteria.

4. Sort the alternatives in decreasing order by the values S, R, and Q.
5. Propose the alternative (a') that is ranked the best by the measure Q (minimum) as a compromise solution if the following two requirements are met:

C1: "Acceptable advantage"

$DQ = 1/(J - 1)$; J is the number of alternatives
a'' is the alternative with the second position in the ranking list by Q.

$$Q(a'') - Q(a') \geq DQ$$

C2: "Acceptable stability in decision making". Alternative a' must likewise be ranked highest by S or/and R. This compromise solution is stable inside a decision-making process, such as "vote by majority rule" (where v>0.5 is required), "by consensus" (v≈0.5), or "with veto" (v<0.5). In this case, v represents the weight of the decision-making method "the majority of criteria" (or "the largest group utility").

If one of the requirements is not met, a set of compromise options consisting one of the following two is provided:

Alternatives a′ and a′′ if only conditions C2 is not satisfied, or

Alternatives a′, a′′,…, $a^{(M)}$ if condition C1 is not satisfied; and $a^{(M)}$ is determined by the relation $Q(a^{(M)}) - Q(a') < DQ$ for maximum M (the positions of these alternatives are "in closeness").

The best option, as rated by Q, is the one with the lowest Q value. The compromise ranking list of alternatives, as well as the compromise solution with the "advantage rate," are the primary ranking results.

## PROPOSED SELECTION APPROACH AND CASE STUDY

In this study, three AOI systems for solder paste inspection are tested for the same ten components on one type of assembled PCBs. The reason for analyzing components on the same type of PCBs is to measure inspection accuracy in detail for these three systems. This selection will affect the whole PCB assembly process. Therefore, the measuring sensitivity of AOI systems on components has crucial importance for the electronics company.
Criteria for selecting the most accurate AOI system for the company are PCB Bending for original, 850 mic and 1600 mic, repeatability, rotation for 0, 90, 180 and 270 degrees, and r-pass rates. The means of test results for ten experiments are presented in Tables 2, 3, and 4.

**Table 2.** Test results for AOI-1

| AOI 1 | PCB BENDING | | | | ROTATION | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | orjinal | 850 mik | 1600 mik | REPEATABILITY | 0 | 90 | 180 | 270 | R-PASS |
| U163_1 | 109.37 | 108.72 | 108.46 | 132.84 | 52.41 | 65.07 | 53.50 | 50.45 | 0.92 |
| U163_2 | 83.63 | 86.33 | 89.92 | 117.42 | 49.68 | 53.79 | 57.31 | 67.60 | 0.89 |
| U164_1 | 87.31 | 83.84 | 84.59 | 106.63 | 41.62 | 51.41 | 53.09 | 55.38 | 0.80 |
| U164_2 | 130.34 | 125.92 | 128.70 | 98.88 | 57.70 | 47.37 | 43.25 | 56.56 | 0.81 |
| U157_1 | 78.35 | 79.69 | 78.01 | 74.87 | 74.30 | 79.53 | 74.95 | 76.79 | 0.76 |
| U157_2 | 65.27 | 64.63 | 64.23 | 53.70 | 78.56 | 80.69 | 75.30 | 75.31 | 0.76 |
| CN707_1 | 86.16 | 86.94 | 86.50 | 84.00 | 83.98 | 85.21 | 88.02 | 86.82 | 0.38 |
| CN707_2 | 89.15 | 88.74 | 87.16 | 77.85 | 89.91 | 88.34 | 80.69 | 80.89 | 0.39 |
| CN708_1 | 82.96 | 81.77 | 81.95 | 77.39 | 78.08 | 80.51 | 85.74 | 84.46 | 0.72 |
| CN708_2 | 77.53 | 76.68 | 78.51 | 72.15 | 81.99 | 83.12 | 81.87 | 80.41 | 0.71 |
| Std. Dev. | 17.34 | 16.34 | 16.97 | 22.69 | 15.99 | 14.76 | 15.20 | 12.47 | 0.18 |
| Mean | 89.01 | 88.33 | 88.80 | 89.57 | 68.82 | 71.50 | 69.37 | 71.47 | 0.71 |
| CV | 19.49 | 18.50 | 19.11 | 25.33 | 23.24 | 20.64 | 21.91 | 17.44 | 24.69 |

**Table 3.** Test results for AOI-2

| AOI 2 | PCB BENDING | | | | ROTATION | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | orjinal | 850 mik | 1600 mik | REPEATABILITY | 0 | 90 | 180 | 270 | R-PASS |
| U163_1 | 76.56 | 75.44 | 74.26 | 75.33 | 69.21 | 63.95 | 65.87 | 69.40 | 0.90 |
| U163_2 | 73.75 | 73.95 | 73.03 | 65.61 | 85.10 | 78.49 | 85.56 | 79.93 | 0.91 |
| U164_1 | 71.52 | 71.14 | 70.20 | 111.20 | 86.21 | 84.13 | 88.10 | 85.54 | 0.75 |
| U164_2 | 82.59 | 82.95 | 82.75 | 80.88 | 77.38 | 82.30 | 83.01 | 81.85 | 0.74 |
| U157_1 | 122.23 | 122.66 | 120.85 | 117.50 | 140.81 | 132.99 | 131.62 | 133.71 | 0.78 |
| U157_2 | 141.68 | 140.24 | 141.23 | 151.92 | 144.11 | 144.54 | 150.93 | 149.60 | 0.78 |
| CN707_1 | 125.26 | 126.82 | 126.67 | 107.10 | 119.11 | 108.11 | 121.63 | 100.40 | 0.40 |
| CN707_2 | 123.11 | 124.33 | 124.60 | 110.26 | 116.90 | 105.95 | 120.27 | 111.55 | 0.41 |
| CN708_1 | 116.32 | 116.62 | 118.91 | 112.43 | 123.63 | 114.73 | 120.70 | 103.20 | 0.69 |
| CN708_2 | 126.01 | 127.52 | 129.63 | 119.33 | 114.44 | 99.40 | 116.26 | 106.86 | 0.70 |
| Std. Dev. | 25.20 | 25.50 | 26.22 | 23.88 | 25.12 | 23.87 | 25.03 | 23.70 | 0.17 |
| Mean | 105.90 | 106.17 | 106.21 | 105.16 | 107.69 | 101.46 | 108.40 | 102.20 | 0.71 |
| CV | 23.80 | 24.02 | 24.69 | 22.71 | 23.32 | 23.52 | 23.09 | 23.19 | 23.48 |

**Table 4:** Test results for AOI-3

| AOI 3 | PCB BENDING | | | | ROTATION | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | orjinal | 850 mik | 1600 mik | REPEATABILITY | 0 | 90 | 180 | 270 | R-PASS |
| U163_1 | 42.56 | 41.53 | 40.72 | 46.15 | 59.55 | 54.86 | 62.33 | 56.90 | 0.94 |
| U163_2 | 45.49 | 42.47 | 40.68 | 45.39 | 39.75 | 39.40 | 36.42 | 31.25 | 0.93 |
| U164_1 | 71.32 | 68.80 | 68.88 | 61.60 | 29.08 | 31.60 | 31.62 | 28.98 | 0.79 |
| U164_2 | 66.72 | 60.65 | 58.83 | 44.08 | 38.15 | 39.13 | 33.98 | 31.29 | 0.79 |
| U157_1 | 89.61 | 84.94 | 84.44 | 98.37 | 87.74 | 99.88 | 83.47 | 91.64 | 0.75 |
| U157_2 | 81.41 | 81.47 | 86.82 | 91.98 | 94.08 | 94.87 | 86.52 | 104.46 | 0.75 |
| CN707_1 | 127.61 | 126.69 | 126.64 | 125.23 | 120.56 | 113.38 | 110.22 | 107.25 | 0.41 |
| CN707_2 | 109.55 | 109.57 | 112.49 | 112.62 | 117.71 | 99.39 | 106.69 | 104.12 | 0.43 |
| CN708_1 | 116.42 | 115.02 | 115.01 | 124.43 | 118.45 | 115.92 | 117.74 | 111.61 | 0.71 |
| CN708_2 | 126.60 | 123.89 | 124.46 | 114.08 | 118.39 | 106.41 | 113.32 | 103.34 | 0.70 |
| Std. Dev. | 29.97 | 30.53 | 31.33 | 32.08 | 35.50 | 32.23 | 32.94 | 33.77 | 0.17 |
| Mean | 87.73 | 85.50 | 85.90 | 86.39 | 82.35 | 79.48 | 78.23 | 77.08 | 0.72 |
| CV | 34.16 | 35.70 | 36.47 | 37.13 | 43.12 | 40.54 | 42.11 | 43.81 | 23.44 |

Since we aim to select the AOI with the highest precision, we need to evaluate them based on their results on different components. Although we know the means and standard deviations of the test results, they do not give us enough information for the selection. Since we do not know the real values of the test criteria, we cannot decide which AOI is the best one. Here, our novel selection approach comes into the stage.

When we examine the means and standard deviations, we can see that different AOIs have different means and standard deviations for components. The scales of the tests are also different, so it will not be statistically possible to compare the mean of the means for all components. Only the coefficient of variation (CV) statistic, which is defined as the ratio of the standard deviation to the mean or its absolute value, may be compared in this situation. The mean CV statistics for AOIs are 21.15, 23.54, and 37.39, respectively. By looking at this piece of information, the selection of AOI-1 is a reasonable decision since it has the smallest mean CV across all components and all test criteria. However, we need a two-way evaluation; both component-wise and criteria-wise.

Our proposed approach is an effort to make a more information-based decision by also investigating the rankings of component test scores. The stages of the proposed approach are as follows:

1. Test scores are recorded for all components.
2. Standard deviation, mean, and CV of the test scores are calculated for each component.
3. Test scores are evaluated by TOPSIS and VIKOR and component rankings are obtained.
4. Standard deviation, mean, and CV of the rankings are calculated for each component.
5. Since we aim to select the best AOI across components and the test criteria, rankings that are closer to each other (smaller CV) should be preferred.

The ranking of components, tested by AOI-1, AOI-2, and AOI-3, are calculated by TOPSIS and VIKOR (Table 5).

**Table 5.** TOPSIS and VIKOR results for AOI systems.

| | TOPSIS (Ci*) | | | VIKOR (Qj) | | |
|---|---|---|---|---|---|---|
| | AOI-1 | AOI-2 | AOI-3 | AOI-1 | AOI-2 | AOI-3 |
| CN707_1 | 0.62 | 0.65 | 0.96 | 0.00 | 0.32 | 0.00 |
| CN707_2 | 0.61 | 0.66 | 0.85 | 0.05 | 0.22 | 0.13 |
| CN708_1 | 0.46 | 0.55 | 0.79 | 0.38 | 0.54 | 0.42 |
| CN708_2 | 0.43 | 0.55 | 0.79 | 0.43 | 0.53 | 0.42 |
| U157_1 | 0.39 | 0.63 | 0.58 | 0.55 | 0.47 | 0.60 |
| U157_2 | 0.34 | 0.73 | 0.59 | 0.88 | 0.37 | 0.60 |
| U163_1 | 0.47 | 0.05 | 0.21 | 0.78 | 1.00 | 0.94 |
| U163_2 | 0.36 | 0.13 | 0.06 | 0.87 | 0.94 | 1.00 |
| U164_1 | 0.31 | 0.24 | 0.19 | 1.00 | 0.90 | 0.94 |
| U164_2 | 0.49 | 0.18 | 0.15 | 0.75 | 0.82 | 0.96 |
| Std. Dev. | 0.10 | 0.24 | 0.32 | 0.33 | 0.27 | 0.34 |
| Mean | 0.45 | 0.44 | 0.52 | 0.57 | 0.61 | 0.60 |
| CV | 22.01 | 55.84 | 61.75 | 58.61 | 43.47 | 56.66 |

TOPSIS and VIKOR results rate alternatives based on how near they are to the ideal solution. The best alternative in TOPSIS is the one with the highest ranking. The solution method of VIKOR, on the other hand, calculates the highest-ranked alternative around zero. The dispersion of results between ideal and negative ideal solution supports us to determine the sensitivity of the three AOI systems. If the best alternatives for TOPSIS and VIKOR according to three suppliers are

examined, it is obvious that they are approximately similar. In other words, both methods produce approximately the same orders of alternatives. We are interested in the inspection accuracy of these machines. So, we need to know which machine's measurements are more reliable than others. Since a small range of the results is required, a smaller standard deviation is better, however from a statistical point of view, evaluating CVs is better. When CVs of all results for each AOI system are calculated, it's obvious that according to the TOPSIS method AOI-1's measurements are more sensitive than others. Since VIKOR transforms results in the range of 0-1, it changes their structure and it induces them to fluctuate. However, VIKOR also gives the same result as TOPSIS, AOI-1 has smaller dispersion.

Test results of AOI-1 aren't close to the ideal point. It provides average values for inspection accuracy. Test results of AOI-2 and AOI-3 are closer to the ideal point, but they also provide results that are close to the negative-ideal point. According to the mean and the standard deviation values of these results, the TOPSIS method produces a smaller CV for AOI-1 than other AOIs. It means that the inspection accuracy of AOI-1 is more stable than those of other machines. In this manner, the CVs of other machines are higher than AOI-1. It means that they could have sensitive measures, but also, they could get measures close to the negative-ideal point. We cannot be sure of the inspection accuracy of their results. According to these results, the preference ordering of these three suppliers should be: AOI-1 > AOI-3 > AOI-3. Therefore, we can recommend the company to choose AOI-1.

## CONCLUSIONS

Our problem was that the selection should be made based on two dimensions instead of only one. When the results are examined, multi-criteria decision-making methods reduce the multidimensional and complex structure of the problem to a single ordered list for decision-makers. The coefficient of variation of the rank list shows how the results spread around the mean. The CV of the ordered list provides important information to the decision-maker regarding the accuracy and precision of the machines from which the data is obtained. Multi-criteria decision-making methods are useful tools for the decision-makers not only by sorting results and selecting the best one but also by descriptive statistics of the ordered list.

## REFERENCES

Breaz, R. E., Bologa, O. and Racz, S. G. (2017). Selecting industrial robots for milling applications using AHP. *Procedia computer science*, *122*, 346-353.

Huang, C. Y., Lin, Y. H., Ying, K. C. and Ku, C. L. (2011). The solder paste printing process: critical parameters, defect scenarios, specifications, and cost reduction. *Soldering & surface mount technology*.

Dave, N., Tambade, V., Pandhare, B. and Saurav, S. (2016). PCB defect detection using image processing and embedded system. *International Research Journal of Engineering and Technology (IRJET)*, *3*(5), 1897-1901.

Deng, H., Yeh, C. H. and Willis, R. J. (2000). Inter-company comparison using modified TOPSIS with objective weights. *Computers & Operations Research*, *27*(10), 963-973.

Gunn, R. and Ries, B. (2001, January). Selecting and implementing solder paste inspection for SMT process control. In *IPC SMEMA Council APEX* (pp. 31-38).

Ghorabaee, M. K. (2016). Developing an MCDM method for robot selection with interval type-2 fuzzy sets. *Robotics and Computer-Integrated Manufacturing*, *37*, 221-232.

Gitinavard, H., Mousavi, S. M., Vahdani, B. and Siadat, A. (2016). A new distance-based decision model in interval-valued hesitant fuzzy setting for industrial selection problems. *Scientia Iranica*, *23*(4), 1928-1940.

Guo, F. and Guan, S. A. (2011, August). Research of the machine vision based PCB defect inspection system. In *2011 International Conference on Intelligence Science and Information Engineering* (pp. 472-475). IEEE.

Hwang, C. L. and Yoon, K. (1981). Multiple criteria decision making. *Lecture Notes in Economics and Mathematical Systems*, *186*, 58-191.

Jahan, A., Mustapha, F., Ismail, M. Y., Sapuan, S. M. and Bahraminasab, M. (2011). A comprehensive VIKOR method for material selection. *Materials & Design*, *32*(3), 1215-1221.

Jahanshahloo, G. R., Lotfi, F. H. and Izadikhah, M. (2006). Extension of the TOPSIS method for decision-making problems with fuzzy data. *Applied Mathematics and computation*, *181*(2), 1544-1551.

Janóczki, M., Becker, Á., Jakab, L., Gróf, R. and Takács, T. (2013). Automatic optical inspection of soldering. *Materials Science-Advanced Topics*.

Karande, P., Zavadskas, E. and Chakraborty, S. (2016). A study on the ranking performance of some MCDM methods for industrial robot selection problems. *International Journal of Industrial Engineering Computations*, *7*(3), 399-422.

Malamas, E. N., Petrakis, E. G., Zervakis, M., Petit, L. and Legat, J. D. (2003). A survey on industrial vision systems, applications and tools. *Image and vision computing*, *21*(2), 171-188.

Mathew, M., Sahu, S. and Upadhyay, A. K. (2017). Effect of normalization techniques in robot selection using weighted aggregated sum product assessment. *Int. J. Innov. Res. Adv. Stud*, *4*(2), 59-63.

Opricovic, S. and Tzeng, G. H. (2004). Compromise solution by MCDM methods: A comparative analysis of VIKOR and TOPSIS. *European journal of operational research*, *156*(2), 445-455.

Opricovic, S. and Tzeng, G. H. (2007). Extended VIKOR method in comparison with outranking methods. *European journal of operational research*, *178*(2), 514-529.

Opricovic, S. (1998). *Multicriteria optimization of civil engineering systems*. Faculty of Civil Engineering, *Belgrade*, *2*(1), 5-21.

Parameshwaran, R., Kumar, S. P. and Saravanakumar, K. (2015). An integrated fuzzy MCDM based approach for robot selection considering objective and subjective criteria. *Applied Soft Computing*, *26*, 31-41.

Ray, R. (1988). Automated visual inspection of solder bumps. *AT&T technical journal*, *67*(2), 47-60.

Rezaei-Malek, M., Mohammadi, M., Dantan, J. Y., Siadat, A. and Tavakkoli-Moghaddam, R. (2019). A review on optimisation of part quality inspection planning in a multi-stage manufacturing system. *International Journal of Production Research*, *57*(15-16), 4880-4897.

Sanayei, A., Mousavi, S. F. and Yazdankhah, A. (2010). Group decision making process for supplier selection with VIKOR under fuzzy environment. *Expert Systems with Applications*, *37*(1), 24-30.

Sayadi, M. K., Heydari, M. and Shahanaghi, K. (2009). Extension of VIKOR method for decision making problem with interval numbers. *Applied Mathematical Modelling*, *33*(5), 2257-2262.

Sen, D. K., Datta, S. and Mahapatra, S. S. (2016). Application of TODIM (Tomada de Decisión Inerativa Multicritero) for industrial robot selection. *Benchmarking: An International Journal*.

Sen, D. K., Datta, S. and Mahapatra, S. S. (2016). Extension of PROMETHEE for robot selection decision making. *Benchmarking: An International Journal*.

Tempoautomation, (May 2018). *Circuit Board Testing Methods for PCB Manufacturing*, https://www.tempoautomation.com/blog/circuit-board-testing-methods-for-pcb-manufacturing/(Last Access: 28.06.2020)

Triantaphyllou, E. (2000). Multi-criteria decision making methods. In *Multi-criteria decision making methods: A comparative study* (pp. 5-21). Springer, Boston, MA.

Tzeng, G. H., Lin, C. W. and Opricovic, S. (2005). Multi-criteria analysis of alternative-fuel buses for public transportation. *Energy Policy*, *33*(11), 1373-1383.

Wang, W. C., Chen, S. L., Chen, L. B. and Chang, W. J. (2016). A machine vision based automatic optical inspection system for measuring drilling quality of printed circuit boards. *IEEE Access*, *5*, 10817-10833.

Wikipedia, https://en.m.wikipedia.org/wiki/Surface-mount_technology. (Last Access: 28.06.2020)

Xue, Y. X., You, J. X., Zhao, X. and Liu, H. C. (2016). An integrated linguistic MCDM approach for robot evaluation and selection with incomplete weight information. *International Journal of Production Research*, *54*(18), 5452-5467.

You, X. Y., You, J. X., Liu, H. C. and Zhen, L. (2015). Group multi-criteria supplier selection using an extended VIKOR method with interval 2-tuple linguistic information. *Expert Systems with Applications*, *42*(4), 1906-1916.

Zeleny, M. (1982). Multiple Criteria Decision Making, McGraw-Hill, Company.

Zhou, F., Wang, X. and Goh, M. (2018). Fuzzy extended VIKOR-based mobile robot selection model for hospital pharmacy. *International Journal of Advanced Robotic Systems*, *15*(4), 1729881418787315.

JOMAES

Journal of Management and Economic Studies

2022, 4(1): 59-81 DOI: 10.26677/TR1010.2022.959

Journal Homepage: https://www.jomaes.org

# Evaluation of Contemporary Management Approaches in Hotel Businesses: A Qualitative Application in Four and Five Star Hotels

**F. Feyza İNCE**
Ankara Hacı Bayram Veli University, Tourism Faculty, Ankara. firdevs.ince@hbv.edu.tr https://orcid.org/0000-0003-1428-5484

**Büşra ÖZTÜRK**
Ankara Hacı Bayram Veli University, Institute of Graduate Programs, Master Degree Student, Ankara. busra.ozturk@hbv.edu.tr https://orcid.org/0000-0001-8720-8557

**İpek KUMKALE**
Ankara Hacı Bayram Veli University, Institute of Graduate Programs, Master Degree Student, Ankara. ipek.kumkale@hbv.edu.tr https://orcid.org/0000-0002-1384-4427

**Kübra TÜT**
Ankara Hacı Bayram Veli University, Institute of Graduate Programs, Master Degree Student, Ankara. kubra.tut@hbv.edu.tr https://orcid.org/0000-0001-7569-5933

**Oktay KARACA**
Ankara Hacı Bayram Veli University, Institute of Graduate Programs, Master Degree Student, Ankara. oktay.karaca@hbv.edu.tr https://orcid.org/0000-0002-3053-5220

**Şule Betül SAĞLAM**
Ankara Hacı Bayram Veli University, Institute of Graduate Programs, Master Degree Student, Ankara. saglam.sulebetul@hbv.edu.tr https://orcid.org/0000-0001-7981-8945

## Abstract

Intense competitive environment makes it mandatory for hotel businesses to apply modern management approaches. In this direction, the aim of the study is to determine at what level contemporary management approaches are applied in four and five-star hotel businesses. The phenomenology model, one of the qualitative research models, was used in the research. The working group consists of 10 hotel businesses with four and five stars located in Ankara, İstanbul, Muğla and Antalya. A total of 61 questions were asked to the study group. Interviews were held with the managers of the hotel businesses. The data were obtained by content analysis and the findings were presented comparatively in the form of a table. As a result of the study, it has been determined that while the majority of the hotels apply most of the modern management approaches at the high level, there are also the hotel businesses that apply them at the middle and lower level. It can be interpreted that this situation is caused by the fact that they are not an international chain hotel business and they do not have sufficient knowledge about contemporary management approaches. As a result of the study, suggestions were made about every contemporary management approach to hotel businesses.

**Keywords:** Contemporary Management Approaches, Management Science, Tourism Sector, Hotel Management.

## 1. INTRODUCTION

Management concept; it is defined as a roadmap (Memduhoğlu, 2010:2) that is followed in line with the targets determined by organizing the tools necessary to achieve certain objectives in enterprises and can also be defined as performing tasks through individuals. In the period from the past to the present, with the industrial revolution, major wars, technological changes in information and communication and the effects of globalization, after 1960, classical management approaches were replaced by contemporary management approaches. Contemporary management approaches, as a basic philosophy, aim to compensate for the shortcomings of previous management approaches and to improve their negative aspects. To summarize, contemporary management approach; customer focus, quality, effective use of resources, creativity, and human value (Şimsek, 2005:88).

In this article, it can be seen how to contemporary management approaches such as Total Quality Management, Management by Objectives, Network Organizations, Benchmarking, Workforce Empowerment, Learning Organizations, Institutionalization, Reconstruction, Intellectual Capital, and Outsourcing are examined under the main topics.

Hotel businesses have had to change and update their service strategies to survive and maintain over time. First of all, the changing issues are in vision and mission issues. In addition, enterprises should determine their strategies and policies, target the total quality of their services, and continuously train their employees in order to ensure the quality of service (Bedük, Muammer and Abdullah, 2008:136). In addition, they should examine the markets in the sector well and make changes by modeling and adapting the structures of the businesses that are leaders in the markets, identifying the strengths and weaknesses of the enterprise and going through the restructuring process accordingly.

Hotel businesses in the service sector need to implement modern management approaches in order to ensure continuity and sustain their growth and revenue growth. The existence of contemporary management approaches is one of the main factors that create the branding phenomenon for both domestic and foreign customers of enterprises in the tourism sector. The quality of service and continuity of the quality of service of hotel enterprises is an indispensable issue in order to ensure satisfaction with both employees and customers. There is an intense competitive environment in the tourism sector. In order to withstand these intense competitive conditions and to raise the business to the level of international enterprises, modern management approaches must be fully implemented under the leadership of technological developments (Kara and Çavuş, 2014:483).

In this study, the theoretical framework and concept definitions of contemporary management approaches that develop with globalization are given. The aim of this study is to determine and interpret the extent to which four- and five-star hotel businesses use contemporary management approaches with the help of the findings obtained. In this context, the research issue; the level at which contemporary management approaches are applied to four and five-star hotel businesses.

## 2.CONTEMPORARY MANAGEMENT APPROACHES

### 2.1.Total Quality Management

Total quality management (TQM) is a process that starts with the quality request and will of the organization. The value, quality, and efficiency of the organization are determined by the satisfaction rates of its customers. Factors such as the establishment of mutual trust in the organization, the failure to make mistakes, the support of decisions with data and the instilling of team spirit form the basis of the relations within the organization. TQM, which is an

understanding of innovation, is welcomed by organizations as it is a holistic approach to not making wrong or incomplete decisions (İlgan et al., 2008:79). TQM should be made into a way of thinking in all activities of the organization within a holistic system, spreading quality to all areas, making people a focal point, developing goods and services, participating the whole organization in the whole process, continuous development and learning. TQM is a form of business that adopts to maximize customer satisfaction by identifying not only the present but also the desires and expectations that may occur in the future (İlgan et al., 2008:73-74). Although TQM has many objectives, its main objectives are; minimizing extravagance, increasing efficiency, continuous increase in quality, reducing expenses, reducing processing times, ensuring continuous improvement, and development, ensuring balance between stakeholders (Özgüner and Özgüner, Z. 2015: 443). Leadership, continuous improvement (Kaizen), customer focus and participative management principles must be adopted in order for TQM to reach the whole organization.

**Leadership:** TQM can be defined as a management philosophy aimed at effective use of all existing resources with the participation of all business partners in the management process in order to develop and implement approaches to preventing mistakes in order to realize the visions and missions of the organization (Taş ve Aksu, 2011: 353).

**Continuous Improvement (Kaizen):** The main thing in continuous improvement is not to see the existing situation as effective, but always to take it one step forward. Kaizen has always philosophized a management style that demands better and is never satisfied with the existing process. The ever-changing expectations of customers require a continuous increase in the quality of the goods or services produced (İlgan et al., 2008:76).

**Customer Focus:** TQM considers all individuals who are buyers of goods or services as customers. All activities of the organization are based on meeting the demands of customers. Organizations will be memorable and valued as long as they improve the quality for their customers (Önder,1998:65).

**Participating Management:** In order for TQM to succeed, the participation of the entire hierarchical structure from the lowest level to the highest level must be ensured. Success will be permanent when all employees make total quality management a way of thinking (Coşkun, 2003:57).

TQM is a form of management based on continuity and efficiency, but starting with determining which methods organizations will move forward and how to carry out them, it is a management approach that covers the participation of all employees in the processes, achieving the desired quality, and continuous improvement and development efforts, regardless of the upper and subordinate distinctions within the organization. Among the benefits of TQM, it can be conveyed as positive results such as increased organizational awareness, high profits, appealing to more customers, decreased employee turnover, more meaningful work of employees with their participation in the field of management, increasing intra-organizational culture by forming teams, increasing brand awareness (İlğan et al., 2008:79).

## 2.2.Management by Objectives

One of the contemporary management approaches, Management by Objectives (MBO) theory, was first described by Peter F. Drucker in 1954 (Yildiz and Cobanoglu, 2016:343). According to Drucker, MBO is a system for balancing organizational objectives and merging between activities. The MBO process consists of managers in senior management setting targets with lower-level managers and determining the responsibilities of each employee according to the expected results of them in relation to the field of duty. Therefore, when the relevant literature is examined; it

appears to have been examined as management by results, management with results, management by objectives, and results (Efil, 1999:189 as cited in. Koç and Topaloglu, 2017:167).

MBO is an understanding that enables the cooperation of the organization and employees, allows the powers and responsibilities of individuals, directs their opinions and efforts in a common way, and brings together the objectives of the organization on the same plane as the objectives of the individual (Aydın, 2013:111). MBO is a process in which the top and subordinates in an organization determine their objectives together, decide their areas of responsibility, and the results they will achieve together, and examine together whether these objectives and results have been realized in certain periods (Koç and Topaloglu, 2017:168).

When determining the objectives, it should be taken care that it is clear, understandable, measurable, and achievable. Objectives start from senior management and descend to submanagement in the form of a hierarchy of objectives, thus ensuring integrity. During the activity planning phase, it is determined how to achieve the objectives set out in the strategic plan and reduced to the level of department and person. In this way, while the individual develops his/her abilities, the organization benefits from the individual's abilities. The phase of application and self-control is the stage in which plans are implemented and deviations are determined, if any. Periodic valuations are the valuation process that is carried out at certain time intervals. Thus, the performance of the workers is measured and rewarded if necessary (Koçel, 1999:98; Efil, 1999:194; Şimşek, 2005:284 as cited in. Koç and Topaloglu, 2017:168-169).

## 2.3.Network Organizations

With the globalization process, organizations are redesigning their organizational structures in order to achieve superiority in the market, efficiency/effectiveness and service quality (Kanbur, 2008: 389). Network organizations are a group of businesses that are in mutual relations independently of each other, do not have a hierarchical superiority between them, but divide the work among themselves with certain agreements and produce goods and services, as well as sell what they produce. By using the network organizational structure, companies continue their business in an effective and innovative way; concentrates on doing the work properly and operates in a way to make agreements with other companies (Koçer and Erdoğmuş, 2011: 247).

Network organizations are named according to their structure. Network organizations are examined under three main headings in the literature: Internal, balanced and dynamic. *Internal network organizations,* can be expressed as an organization whose organizational units interact with each other and can establish formal and informal relations. In this context, formal relations include ties, resource exchange and personnel transfers through workflow (Brass et al., 2004: 801). In *balanced network organizations*, resource ownership and property savings of enterprises producing goods or services occur independently of each other, when they are in a supply and demand relationship (Karaaslan et al., 2003: 25). In addition, this organizational structure is a form of outsourcing (Saylı et al., 2006: 33). The defining feature of *dynamic network organizations* is the absence of the main business. In this type of organizational structure, the formation of enterprises that are completely independent in their field around any enterprise that functions as an indirect organizer is essential. In other words, organization emerges cyclically between businesses and a network is formed (Karaaslan et al., 2003: 25).

## 2.4.Outsourcing

Today, it is known that enterprises prefer modern management approaches in order to gain a competitive advantage, as multiple contemporary management approaches such as total quality management, benchmarking, outsourcing, workforce empowerment. All of these approaches are

integrated with the enterprise in order to strengthen the enterprise and increase its share in the market.

Outsourcing, which is one of the modern management approaches, is called outsourcing of private work that requires expertise and is outside of its core capabilities (Arslan ve Aydoğmuş, 2020:466). In industrialized parts of the world, outsourcing has become an increasingly popular method for companies to organize their production in order to gain the advantage of competitiveness (Shy ve Stenbacka, 2003:203). Outsourcing differs from alliances, partnerships, or joint ventures in that resource flow is one-way from provider to user. Typically, there is no profit sharing or mutual contribution (Belcourt, 2006:270).

Businesses can opt for an outsourcing approach in a single activity in the production process or outsource one or more functions of the enterprise (Turan,2014:155). Turan (2014) conveys the advantages of outsourcing as follows:

- Optimal use of financial resources
- Reducing costs and improving quality (outsourcing has the advantage of reducing costs by preventing the formation of new costs)
- Being able to become a successful business
- Gain speed
- Downsizing and preparing for global competition
- Gaining a strategic perspective
- Process renewal and ability to follow technological innovations

The ability of businesses to achieve the above-mentioned advantages requires effective outsourcing management. The disadvantages that outsourcing can bring (Turan, 2014:157); increasing dependence on supplier operation and loss of control, preference of unqualified supplier, loss of abilities of the enterprise, risk of loss of control over personnel, focus on short-term economic objectives.

It is possible to say that the disadvantages of outsourcing arise with the selection of more suppliers, as mentioned above. Supplier selection needs to be done correctly and the business as a new competitor must maintain its core capabilities, especially in order not to pose a risk to the business. In order to effectively execute outsourcing, situationality can be used more effectively as a result of its handling and evaluation together with dynamic capabilities and business model approaches (Turan,2014:160).

## 2.5.Benchmarking

With globalization, intercultural interaction, preference of foreign markets and open markets, change and development have become a necessity for enterprises. Therefore, businesses have to prioritize the desires and expectations of their customers, adopt innovative understandings and control the changes that ocur (Efe, 2019:95). The concept of comparison emerged in the 1970s, and it is possible to say that it dates back to the 1980s when businesses started to carry out benchmarking studies in order to move their assets forward and keep up with innovations.

In today's increasing globalization, increasing competition in domestic and foreign markets and increasing quality expectations of customers push businesses to develop and implement a number of different quality ideas in order to stay competitive or increase competitiveness, and therefore direct organizations to compare them with the urge to be the 'best of the best' (Erdem, 2006:66).

No common definition has yet been adopted for comparison. However, Erdem (2006)'s definition of comparison adequately summarizes the basis of the comparison: In parallel with the increasing competition in the world through globalization, organizations need to constantly follow innovations and developments, and compare their improvement-required practices with other businesses or departments with best practices within the enterprise (internal or external comparison) without any difference in sector and unit to adapt best practices to the business or unit structure. To briefly convey the objectives underlying the comparison, we can list them as follows;

- Ensuring a change in product, processes and services for the better
- Achieving customer satisfaction and performance improvement
- Gaining a competitive advantage in the existing sector

In order for the benchmarking studies to be successful, planning (determining what will be compared and the business to be compared) must be done correctly. Secondly, the analysis of the enterprise (determination of the lack of performance) should be carried out. Integration as the third stage (findings are evaluated and made acceptable) is required. The fourth stage is taken into action, and the final stage is the maturity stage. At this stage, the business reaches the leadership position and the applications are fully integrated with the processes within the enterprise (Demirdöğen ve Küçük, 2003:309).

Businesses create their strategies to dominate the market or compete with their competitors. Benchmarking technique, which is one of the modern management techniques, can be used in addition to other techniques and requires a great deal of support from management. In order for these techniques to benefit the business, the participation of all working personnel is also required.

## 2.6.Workforce Empowerment

Workforce empowerment is a management approach created by global change and fierce competition. In order for modern organizations to manage their activities effectively and efficiently, they must include dedicated employees (Koçel, 1999:449). Empowerment, refers to an active working atmosphere in which the workforce believes that it can determine its business boundaries and role in the job. Thus, the spiritual feelings that the workers have towards the organization will increase. Empowerment as a management concept; is defined as cooperation, sharing, training, teamwork, increasing the decision-making powers of the employees, and continuously improving the workforce (Erdağ, 2001:3). Empowered workers will take on more responsibility when they feel that the work they are doing is theirs. Their attitudes towards jobs will be more rigorous and their effectiveness within the organization will increase as a result (Doğan, 2006:26).

## 2.7.Learning Organizations

Learning organization approach is defined as organizational structures capable of changing their behavior in line with the information obtained after providing information, gaining information, transmitting information (Toksöz, 2018). According to another definition, learning organizations; they are organizational structures that can adapt to constantly changing environmental conditions, pay attention to past experiences and learn lessons, research the information needed by the organization and thus maximize the contribution of employees to the organization (Kılınç, 2006).

McGill ve Slocum, (1993 as cited in. Kutum, 2017:44-45) examined learning organizations as a four-step development phase. These are the ones that are going to be defined as the organization that knows, the organization that understands, the organization that thinks and the organization

that learns. According to McGill and Slocum studies; the main theme of the organization is to be dedicated to the path of the organization and includes various arrangements by the management and functioning in accordance with the rules. The understanding organizational model emerged with the personnel structure strengthened by the clarity of values and the increase of internal communication. The main purpose of thinking organizations is to focus on the factors that cause problems and eliminate them. Learning organizations are defined as examining, improving and repairing every work experience.

### 2.8.Institutionalization

Institutionalization is the management of the objectives determined by the enterprises with accepted norms, values and principles. In line with the realism and robustness of these goals, the managers of the enterprise feel connected to the institution (Ülgen, 1990: 103). Institutionalization is, in a sense, bringing together and blending of the old and the new. The old and new values, principles brought together are important for the strength and continuity of the relations maintained around the institution. Institutionalization can be explained under five approaches. These approaches differ in essence (Kimberly, 1979: 342). The first approach is the work of Selznick. Emphasizing that the environmental factor is an important factor for businesses in his studies, Selznick underlined that the realization of the harmony of the environment with the business in order to ensure institutionalization and the technical tools in this harmony are important (Selznick, 1996: 271). The second and third approaches are based on Berger's work. Berger focuses on how people's motives and behaviors affect the social order, and the impact of the environment on human behavior (Scott, 1987: 497). In the fourth approach explained by DiMaggio and Powell, it is emphasized that businesses should be acceptable to everyone instead of being moderate in the institutionalization process (Selznick, 1996: 276). In the fifth approach, explained by Friedland and Alford, it is emphasized that businesses act in their interests and while trying to protect them, everyone in the business can attribute different meanings to events (Scott, 1987: 506).

### 2.9.Reconstruction

Reconstruction is a complete reconsideration of all the activities necessary for organizations to survive in the developing competitive conditions, to increase their services by understanding their customers, to create better quality goods and services, to increase their earnings, and to maintain their continuity by fulfilling the development more rapidly (Çetin, 1996: 202).

The characteristics of the restructuring approach, which can handle the changes quickly and apply them to the management, in the conditions of globalization where there is constant change; it is to consider the existing structure from the beginning, to design the changes from a comprehensive perspective, to create added value with the strategically important process logic, to ensure a high increase in productivity and to recreate it (Seymen Aytemiz, 1999: 8-14). Keeping customer expectations and satisfaction at the highest level, which is one of the basic principles of restructuring, being one step ahead in the competition process, coming to the forefront of creativity by adapting quickly to changing conditions, always being open and ready for development, not sacrificing the goals of continuous development and improvement are the principles of a careful and controlled approach. It should be applied in a proper way (Seymen Aytemiz, 1999: 8-14).

### 2.10.Intellectual Capital

The success of organizations today depends on obtaining and retaining information. The concept of intellectual capital is also evaluated in this context. Intellectual capital has an important position in the success of organizations and the realization of their goals in the long term (Senel, 2019:8).

The concept of intellectual capital in the developing 'information world' was first raised in the article "Brain Power" published by Thomas Stewart in 1991. Stewart refers to intellectual capital as "the sum of all the elements known to human factors in a business that give the business a competitive advantage" (Stewart, 1997:19).

Intellectual capital is all assets that are knowledge-based but not seen on the operating balance sheets, which will give a business a competitive advantage over the future and differentiate it from other businesses. These entities; it is possible to rank the culture of the enterprise, copyright and patent rights, the manpower of the enterprise, the structure of the organization, and relations with its customers (Tekin, 2019:431). The main purpose of intellectual capital is to define and develop the processes necessary for the management of intangible assets (Ergun and Yilmaz, 2013:130).

According to Sullivan (2000), elements of intellectual capital; human capital, client capital, intellectual property, R&D, innovation, knowledge, intellectual assets, structural capital, relationship capital, and information technologies (as cited in. Haykır Hobikoglu, 2011:88).

## 3.METHODOLOGY

### 3.1.Model of the Research

This research was created and conducted with the phenomenology model, which is one of the qualitative research methods. The reason for choosing the qualitative research technique in the research is to understand and explain the information, facts and concepts related to the subject to be researched. The purpose of the interview is to determine the subjective perspectives of the participants in the study, in which they explain their feelings, thoughts and knowledge about the subject of the study in detail. In research conducted with interview technique; detailed information about the subject of the research can be collected and the research data are handled in different dimensions (Yüksel, A. 2020: 552). The research issue is to determine at what level contemporary management approaches are applied to four and five-star hotel businesses. Contemporary management approaches discussed in the study have been prepared based on the book study of Koç and Topaloğlu (2017).

### 3.2.Working Group

This study was applied on 10 four and five-star hotels located in Ankara, İstanbul, Antalya and Muğla. 58 four-star hotels, 29 five-star hotels in Ankara; 155 four-star hotels and 117 five-star hotels in Istanbul; 119 four-star hotels and 301 five-star hotels in Antalya; 52 four-star hotels and 49 five-star hotels in Muğla (Rebuplic of Turkey Ministry of Culture and Tourism, 2021). All of the 10 participants in the research are in the managerial position of the enterprises; eight male and two female.

### 3.3.Data Collection

Structured interview form and content analysis method were used as data collection tools. The questions used in the interview were prepared to determine the level of use of contemporary management approaches. The interview questions were arranged with the support of expert opinion after the literature review. There are 61 questions in the interview form (see Appendix) that aim and support the purpose of the research.

Interviews were conducted with the managers participating in the research, both online and face-to-face. The interviews lasted an average of 35-40 minutes. The questions in the interview were arranged to determine whether all contemporary management approaches described in the theoretical framework exist in the relevant enterprise and whether they are also applicable.

### 3.4.Analysis of Data

The information obtained by the researchers was first transferred to the computer environment and then analyzed using content analysis, which is one of the qualitative research techniques. Based on the answers given by the managers, which hotel business incorporates which contemporary management approach has been compared, interpreted and tabulated.

Hotel businesses participating in the interview were expressed in letters as they did not want their names to appear clearly in the study. The hotels interviewed respectively; it has been named as hotel A, hotel B, hotel C, hotel D, hotel E, hotel F, hotel G, hotel H, hotel K and hotel L. These symbols are used in the findings section.

## 4. RESULTS

Six of the hotels participating in the study are located in Ankara, 2 in Antalya, 1 in Muğla, and 1 in İstanbul. Six of the hotels are five-star and 4 are four-star. Five of the hotels participating in the study are operating internationally, while 5 are operating at the national level. Eight of the hotels are chain hotel operations and, 2 are not chain hotel operations. The interviewees are people who are in the managerial position of the hotel establishments. Information about the hotels participating in the study is available in Table 1.

**Table 1. Information about Hotels Participating in the Research**

| | Hotel Location | Star Rating of the Hotel | International Hotel | Chain Hotel | The Task of the Interviewee |
|---|---|---|---|---|---|
| **Hotel A** | Ankara | 4 | Yes | Yes | General Manager |
| **Hotel B** | Ankara | 5 | Yes | Yes | General Manager |
| **Hotel C** | Ankara | 5 | Yes | Yes | General Manager |
| **Hotel D** | Ankara | 4 | No | Yes | Front Office Manager |
| **Hotel E** | Ankara | 4 | No | No | General Manager |
| **Hotel F** | Antalya | 4 | No | No | Purchasing Manager |
| **Hotel G** | Antalya | 5 | No | Yes | General Manager |
| **Hotel H** | Ankara | 5 | No | Yes | General Manager |
| **Hotel K** | Muğla | 5 | Yes | Yes | Front Office Manager |
| **Hotel L** | Istanbul | 5 | Yes | Yes | Sales and Marketing Manager |

The level to which the hotels interviewed apply their contemporary management approaches is shown in Table 2 comparatively.

**Table 2. Findings on The Rates of Use of Contemporary Management Approaches in Hotels**

| | Hotel A | Hotel B | Hotel C | Hotel D | Hotel E | Hotel F | Hotel G | Hotel H | Hotel K | Hotel L | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total Quality Management** | 4 | 5 | 5 | 5 | 3 | 3 | 2 | 5 | 4 | 5 | **4,1** |
| **Management by Objectives** | 3 | 3 | 3 | 5 | 1 | 1 | 2 | 5 | 4 | 5 | **3,2** |
| **Network Organizations** | 5 | 5 | 5 | 1 | 1 | 1 | 2 | 4 | 5 | 5 | **3,4** |
| **Outsourcing** | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 5 | **4,5** |
| **Benchmarking** | 3 | 5 | 5 | 3 | 5 | 5 | 5 | 5 | 5 | 5 | **4,6** |
| **Workforce Empowerment** | 4 | 4 | 5 | 4 | 3 | 5 | 1 | 5 | 5 | 5 | **4,1** |
| **Learning Organizations** | 4 | 4 | 5 | 5 | 3 | 1 | 2 | 5 | 4 | 4 | **3,7** |
| **Institutionalization** | 5 | 5 | 5 | 5 | 1 | 1 | 4 | 5 | 5 | 5 | **4,1** |
| **Reconstruction** | 5 | 5 | 5 | 5 | 1 | 2 | 5 | 5 | 4 | 4 | **4,1** |
| **Intellectual Capital** | 5 | 4 | 5 | 5 | 1 | 1 | 1 | 5 | 5 | 5 | **3,7** |
| **Average** | **4,2** | **4,5** | **4,8** | **4,3** | **2,4** | **2,5** | **2,9** | **4,9** | **4,2** | **4,8** | |

The scoring ruler created according to the findings obtained is given in Table 2. According to the table, decisive scoring on the availability and applicability of contemporary management approaches in the research sample; "1: Very weak, 2: weak, 3: Medium, 4: Good, 5: Very good". Points were classified as "1" points lower level, "2 and 3" points were considered intermediate level, and "4 and 5" points were considered high level. In the hotels interviewed, the level of applying contemporary management approaches was evaluated on a score of "1" for hotels with a level of beginner level.

Approaches with an average of 4 and above when table 2 is examined; total quality management, outsourcing, benchmarking, institutionalization, and reconstruction. These contemporary management approaches are considered to have a high level of availability and applicability on the hotels examined. Approaches with an average of 2 and 3; management by objectives, network organization, learning organizations, intellectual capital. It is seen that it has a intermediate presence and applicability over hotel enterprises that implement these contemporary management approaches. In this study of four- and five-star hotel businesses, there was no contemporary management approach with an average of 1.

According to the findings, hotels with total quality management between 4 and 5 points; hotel A, hotel B, hotel C, hotel D, hotel H, hotel K, and hotel L. Hotels with 2 and 3 points; Hotel E is hotel F and hotel G. There is no hotel with 1 point that implements total quality management. In this

context, it is seen that total quality management has a high level of presence and applicability in 7 hotels and a medium level in 3 hotels.

Hotels in the range of 4 and 5 points in management by objectives; hotel D, hotel H, hotel K, and hotel L. Hotels that apply in the range of 2 and 3 points; hotel A, hotel B, hotel C, and hotel G. Hotels with 1 point are hotel E and hotel F. Management by objectives has been found to have a high level of availability and applicability in 4 hotels, intermediate in 4 hotels, and low level in 2 hotels.

Hotels that apply the network organization approach between 4 and 5 points; hotel A, hotel B, hotel C, hotel H, hotel K and hotel L. There is no hotel with 3 points. The hotel with 2 points is the hotel G. Hotels with 1 point are hotel D, hotel E and hotel F. While it is seen that the network organization approach is applied at a high level in 6 hotels and at a moderate level in 1 hotel, it is seen that it has a low level of presence and applicability in the other 3 hotels.

Hotels in the range of 4 and 5 points in outsourcing; hotel A, hotel B, hotel C, hotel D, hotel E, hotel F, hotel G, hotel H, and hotel L. There are no hotel establishments with 2 and 3 points. The only hotel with 1 point is hotel K. While 9 out of 10 hotels are considered to have a high level of availability and applicability in outsourcing, only 1 is considered to have a low level of availability and applicability.

Hotels with 4 and 5 points in benchmark studies; hotel B, hotel C, hotel E, hotel F, hotel G, hotel H, hotel K, and hotel L. Hotels with 3 points are hotel A and hotel D. There are no hotel establishments with 2 and 1 points. It is seen that 8 of the hotels perform the comparison studies at a high level, while 2 have intermediate availability and applicability.

Hotels that apply the employee empowerment approach between 4 and 5 points; hotel A, hotel B, hotel C, hotel D, hotel F, hotel H, hotel K, and hotel L. The hotel with 3 points is the E hotel. There is no hotel business with 2 points. The hotel with 1 point is the hotel G. It is seen that 8 of the hotels have a high level, 1 hotel is medium level, and 1 hotel is lower level employee have the presence and applicability in the concept of empowerment.

Hotels with a learning organizations approach between 4 and 5 points; hotel A, hotel B, hotel C, hotel D, hotel H, hotel K, and hotel L. Hotels with 2 and 3 points are hotel E and hotel G. The hotel with 1 point is the hotel F. In the learning organizations approach, 7 hotels are high level, 2 hotels are medium level, and 1 hotel is low level availability and applicability.

Hotels that carry out their institutionalization efforts between 4 and 5 points; hotel A, hotel B, hotel C, hotel D, hotel G, hotel H, hotel K and hotel L. There is no hotel business with 2 or 3 points. The hotels with 1 point are the E hotel and the F hotel. It is thought that 8 hotels have the existence and applicability of institutionalization at a high level, while 2 hotels have the existence and applicability of institutionalization at a low level.

Hotels that apply the concept of reconstruction between 4 and 5 points; hotel A, hotel B, hotel C, hotel D, hotel G, hotel H, hotel K, and hotel L. There is no hotel business with 3 points. The hotel establishment with 2 points is the F hotel. The hotel establishment with 1 point is the E hotel. While 8 of the hotels included in the research have a high level of reconstruction availability and applicability, 1 hotel has a medium level, and 1 hotel has a low level of availability and applicability.

Hotels that apply the intellectual capital approach in the range of 4 and 5 points; hotel A, hotel B, hotel C, hotel D, hotel H, hotel K, and hotel L. There are no hotel establishments with 2 and 3 points. Hotels with 1 point are hotel E, hotel F, and hotel G. The approach to intellectual capital

is seen to have a high level of availability and applicability in 7 hotels, while 3 hotels are thought to have a low level of availability and applicability.

**Figure 1. Rates of Hotels Implementing Contemporary Management Approaches**

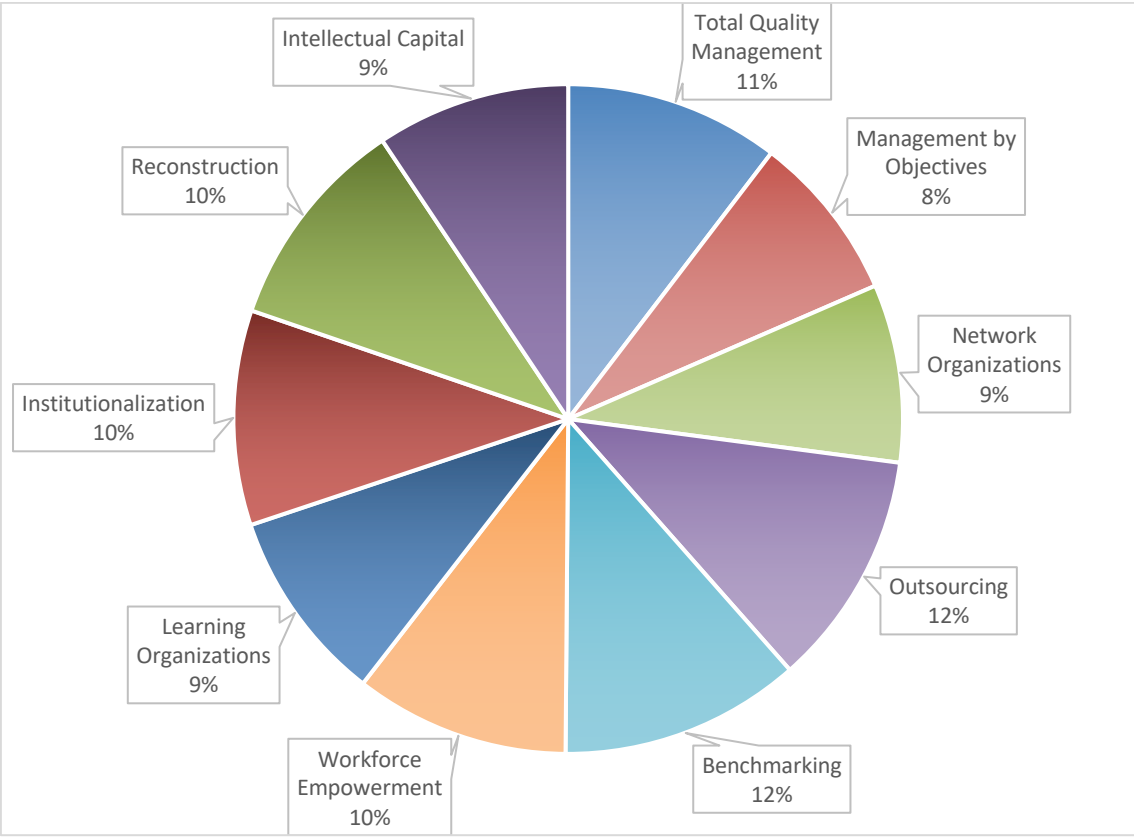



Figure 1 provided the levels at which hotels apply contemporary management approaches. According to Figure 1, it is seen that hotels apply the most outsourcing and benchmarking approach. These approaches are at level of 12%. Then, total quality management with 11%; workforce empowerment, institutionalization, and reconstruction with a rate of 10%; network organizations, learning organizations, and intellectual capital come with %9. It has been determined that hotels apply management by objectives approach lowest purposes which is 8%.

**Figure 2. Rates of Use of Contemporary Management Approaches of Hotels**

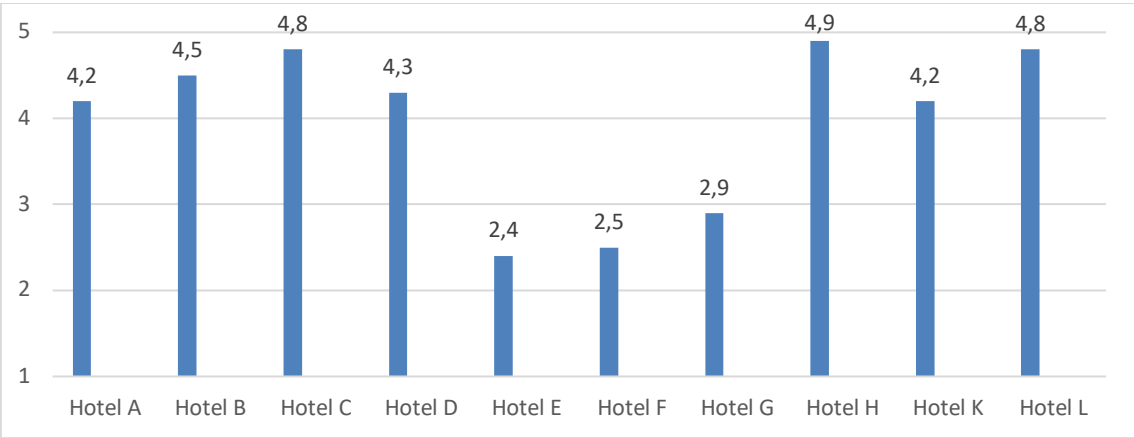


Figure 2 provided the usage rates of contemporary management approaches of the hotels participating in the research. Accordingly, contemporary management approaches are applied to H hotel with 4.9 average, C and L hotel with 4.8 average, B hotel with 4.5 average, hotel D with 4.3 average, A and K hotel with 4.2 average, G hotel with 2.9 average, F hotel with 2.5 average, and E hotel with 2.4 average.

Hotel A, which participated in the research, applies total quality management, network organization approach, outsourcing, workforce empowerment, learning organizations, institutionalization, reconstruction, and intellectual capital at a high level from contemporary management approaches. It carries out management by objectives and benchmarking at intermediate level. Among the hotels examined, hotel A has the presence and applicability of most contemporary management approaches, while it has difficulties in management by objectives and benchmarking understandings according to purposes.

Hotel B included in the research; it carries out all approaches at a high level, except for the management by objective according to objectives, which is one of the contemporary management approaches. The understanding of management by objectives is applied at the medium level. Among the examined hotels, B hotel is considered to have a high level of presence and applicability in most of the contemporary management approaches, while it has difficulties in realizing the management approach according to the objectives compared to other approaches.

As seen in the Table 1, hotel C, which participated in the research, is considered to have a high level of presence and applicability of total quality management, network organization, outsourcing, benchmarking, employee empowerment, learning organizations, institutionalization, reconstruction, and intellectual capital, which are among the contemporary management approaches. As a result of the analyzes made in hotel C, the rate of implementation of the management by objectives approach was determined as medium level.

It was determined that the total quality management, management by objectives, outsourcing, workforce empowerment, learning organizations, institutionalization, reconstruction, intellectual capital at the highest level; benchmarking at the intermediate level, and network organization approach at the lower level, which are among the contemporary management approaches in the D hotel in the research.

E hotel participating in the research; outsourcing and benchmarking studies, which are contemporary management approaches, are at a high level; while total quality management, workforce empowerment and learning organizations were intermediate, it turned out that they had and management by objectives, network organization, institutionalization, reconstruction, and intellectual capital at a low level. Among the hotels examined, it applies most contemporary management approaches at a low level.

F hotel included in the research; outsourcing, benchmarking studies, and workforce empowerment have a high level, total quality management and reconstruction at a medium level and management by objectives, network organization approach, learning organizations approach, institutionalization studies, and intellectual capital at a low level of availability and applicability.

G hotel included in the research; it carries out all approaches at a high level, except for the management by objective according to objectives, which is one of the contemporary management approaches. The understanding of management by objectives is applied at the medium level. Among the examined hotels, G hotel is considered to have a high level of presence and applicability in most of the contemporary management approaches, while it has difficulties in realizing the management approach according to the objectives compared to other approaches.

H and L hotels participating in the study have a high level of availability and applicability of all contemporary management approaches. It is considered that H and L hotels can achieve a sustainable competitive advantage in an increasingly competitive environment with the impact of globalization by applying all modern management approaches.

While the K hotel included in the study has a low level of availability and applicability in outsourcing, it is seen that it has a high level of availability and applicability in all other contemporary management approaches. Although it is an international hotel, it is noted that it may have difficulties in its implementation processes due to its low level of outsourcing.

## 5. CONCLUSION, DISCUSSION AND RECOMMENDATIONS

Due to the increasing competitive environment, hotel enterprises have turned to contemporary management approaches. This study was carried out to determine the extent to which four- and five-star hotel businesses are implementing contemporary management approaches. In line with the findings obtained, the conclusion and recommendations obtained about hotel enterprises can be listed as follows:

It was determined that the majority of hotel enterprises in the working group applied modern management approaches at a high level. However, it has been observed that some hotel enterprises apply contemporary management approaches at medium and low level. It can be supposed that this situation is caused by the fact that they are not an international chain hotel business and do not have sufficient knowledge of contemporary management approaches.

For hotel enterprises that implement the total quality management approach at a medium and low level, first of all, changing the mindset in senior management should be moved away from the classical management approach, develop their vision and missions as a more human-oriented approach, continuously improve the quality within and outside the organization by keeping the customer in the forefront with the inclusion of all employees in the process, not keeping mistakes to a minimum size, it is necessary to spread the whole organization by making it a way of thinking about making no mistakes, to improve the competencies of the employees by providing quality trainings within the whole organization, and to adopt the principles of total quality management by all employees. When total quality management is applied at the highest level in hotel enterprises, it provides advantages such as reducing costs by minimizing wastes, gaining competitive advantage, increasing customers' loyalty to enterprises and ensuring preference continuity, raising quality awareness within the enterprise, maximizing customer satisfaction, adapting quickly to developments, and carrying out processes correctly and positively.

Recommendations can be presented for hotel enterprises that apply the management by objectives approach at a medium and low level, take into account the objectives of the employees of the organization when determining their objectives, ensuring their personal participation in the organization activities, agreeing on the objectives, including the employees of the organization in the management meetings, sharing the decisions taken in the meetings with all business employees in a clear and understandable manner, hanging information boards in the common areas of employees for this sharing (such as dining hall, dressing room), ensuring the participation of all departments in the meetings taking place, and explicitly stating the expectations of subordinates and superiors from each other.

B hotel included in the research; it carries out all approaches at a high level, except for the management by objective according to objectives, which is one of the contemporary management approaches. The understanding of management by objectives is applied at the medium level. Among the examined hotels, B hotel is considered to have a high level of presence and applicability in most of the contemporary management approaches, while it has

difficulties in realizing the management approach according to the objectives compared to other approaches.

Among the hotels examined, it is seen that the hotels apply the outsourcing at a high level and a low level. High-level outsourcing allows hotel businesses to focus and develop their core capabilities, especially by outsourcing jobs that are outside of their core talent. Thanks to outsourcing, businesses can have a flexible structure and thus adapt more easily to the changing environment. In particular, its financial benefits make outsourcing attractive. If a business has decided to outsource, the business must first analyze itself. Then outsourcing strategies should be determined. The other most important point is the choice of supplier. Boundaries with suppliers should be carefully determined, and the choice of suppliers should be taken care of so that self-abilities are not lost and a new competitor is not acquired. In particular, the creation of a culture structure compatible with the service provider is important for the smooth progress of outsourcing. Enterprises that apply outsourcing at a lower level adapt more difficultly to the changing environment due to technological developments and increase the costs of the enterprise.

Benchmarking refers to continuous learning and self-renewal for businesses. It is seen that the hotel enterprises examined grant importance to the comparison studies. Benchmarking efforts are important for reasons such as increasing competitiveness and ensuring that the business has a renewable structure. Businesses can carry out their comparison studies with businesses from the same sector around them, as well as with organizations that are successful and in different sectors. It is possible to say that hotels that carry out high level of comparison studies are hotels that aim to continuously improve, close their shortcomings and have high customer satisfaction. Hotel enterprises carrying out moderate benchmarking studies should prefer their benchmarking efforts in order to increase the chance of competing, to provide customer satisfaction and to have the opportunity to innovate within the organization due to the changes caused by increasing globalization. In order to get the highest efficiency from benchmarking studies, continuity must be required, so once include benchmarking studies, it means that the enterprise cannot get a high level of efficiency from these studies. With benchmarking studies, which are one of the modern management approaches, enterprises will be able to realize innovations integrated with the changing environment.

Various incentive methods in order to create a dynamic structure within the organization for hotel businesses that implement employee empowerment at medium and low levels. As an example, it is recommended that the employees be subject to continuous development in various areas within the social and organization, providing a suitable working environment and salary, and balancing employee authorities by keeping them in the right proportion with their skills. It is recommended for businesses that implement employee empowerment at a high level to apply their job definitions meticulously and clearly in order to avoid confusion and situational crisis and conflicts during the delegation of authority.

For hotel businesses that apply the learning organizations approach at medium and low levels, each individual should participate in the learning and development process in order to increase productivity and increase performance within the organization. When faced with any problem that may arise or an event that has not been encountered until the current situation, it is necessary to give importance to all members of the organization to comment on the solution process and to solve the problems by presenting different perspectives. Organizational behaviors that are constantly researched and changed in line with the information obtained will provide an advantage to businesses. A systematic and easy-to-understand communication environment should be provided and all members of the organization should participate in the learning process as much as possible. Individuals who are in the organization and have a managerial

position should encourage all members of the organization to learn and develop. It is recommended for businesses that apply the learning organizations approach at a high level, to maintain a clear and understandable communication network with a transparent structure and to constantly control the members of the organization. If the accuracy and suitability of the obtained information is not checked, businesses that implement the learning organization approach will not be able to prevent the learning of erroneous or incorrect information. As a result, disruptions and conflicts will occur within the organization.

When the findings of the study are examined, it is seen that the majority of hotel businesses use the institutionalization approach at a high level. Since hotel businesses carry out the institutionalization process within their own structure, they are actually affected by the harmony of internal and external stakeholders in this process. Therefore, some fluctuations can be seen in institutionalization over time. Hotel businesses, which form a systematic structure by showing a tendency to institutionalization, should be able to respond to these changes by having a dynamic structure at the same time in order to compete in the constantly changing and developing environment. The systematic structure to be provided by institutionalization should be supported in line with the needs and vision, together with the dynamism it will add to the business. In order to incorporate the institutionalization approach, hotel businesses need to establish an effective communication between employees, delegate authority when necessary, have division of labor and specialization in the business, build systems that can meet the needs of their customers, achieve long-term success by strengthening customer relations, realize their visions, have the right resources and capacity. It is necessary to use these perspectives more effectively in order to develop the business by using these perspectives at every stage of business management with a strategic point of view.

Hotel businesses, which apply the restructuring approach at low and medium level, should determine the existing situation in the organization by making a SWOT analysis when starting the restructuring practices and they should create a plan for what can be done to do the work better and quality in the organizational structure, work chart, process of the work, human resources behaviors and physical conditions. While going through the restructuring process, they can make the management of the process more effective by getting support from scientific methods by using external resources (consulting firms, professionals, universities, etc.). Hotel businesses, which are in the process of restructuring, should convey their job descriptions to employees in a clear and understandable way. Employees whose job descriptions, work flow charts, and authority charts are clarified will find their tasks more meaningful and will be aware of what powers and abilities they should have. As a result of the research, it is seen that the hotel businesses that implement the restructuring processes provide the competitive advantage of using the technologies developed thanks to the restructuring in their businesses, reaching the customers more quickly with less cost, providing customer satisfaction and shortening the work times.

It is seen that the majority of hotel enterprises examined attach importance to the approach of intellectual capital. It is observed that the relations with human resources, customers, and their environment are highly valued in hotel enterprises carrying out a high level of intellectual capital approach, that they have knowledge and values that will give them an advantage in the sector, that they carry out loyalty and satisfaction studies for their employees, that they have intellectual rights values specific to the enterprise, that they carry out R&D studies frequently and that they aim to continuously develop in this regard by giving importance to the IT infrastructure. Hotel enterprises that carry out intellectual capital studies at a low level must have an intellectual right (such as patents, copyrights, computer software, trade secrets, license agreements) as a priority in order to make a difference to themselves in the sector. In order to increase their competitiveness

and improve their quality level, they should pay attention to it infrastructure studies and carry out R&D studies continuously. They should pay attention to trainings in order to improve the technical knowledge and work characteristics of the workers. The entrepreneurial, competitive, creative thinking, comprehension, analytical and conceptual thinking, teamwork and self-confidence of the workers should be supported by the trainings to be given.

## REFERENCES


Aydın, A. H. (2013). *Yönetim Bilimi: Fonksiyonlar, Teoriler, Yaklaşımlar*. Ankara: Seçkin Yayıncılık.

Arslan, E. Ö. ve Yumurtacı Aydoğmuş, H. (2020). Otel İşletmelerinde Dış Kaynak Kullanımı: TOPSIS Yöntemi ile Bir Uygulama, *Journal Of Tourism And Gastronomy Studies*, (4): 463–477.

Brass, D. J., Galaskiewicz, J., Greve H. R. ve Tsai, W. (2004). TakingStock of Networks andOrganizations: A Multilevel Perspective, *Academy of Management Journal*, 47(6): 795–817.

Bedük, A., Muammer, Z. ve Abdullah, S. (2008). Değişen Dünya'da Yeni Yönetim Modelleri'nin Turizm Sektörü'nde Kullanılması ve Tanıtım Stratejileri'nin Belirlenmesi, *Selçuk Üniveristesi Sosyal Bilimler Enstitüsü Dergisi*, (20): 135-162.

Belcourt, M. (2006). Outsourcing — The Benefits And The Risks, *Human Resource Management Review,* (16): 269–279.

Benchmarkinghome, bkz: ateam.lbl.gov. Referencedfrom: TheAmerican Productivity andQuality Center Web Site. [Date of Access: 12.12.2021]

Brelik, A. (2018). Globalization in Tourism. *"EconomicScienceforRural Development"* 19th International Scientific Conference, 9-11 May, 42-48.

Coşkun, S. (2003). Toplam Kalite Yönetimi ve Yönetim Teorisi, *Amme İdaresi Dergisi*, 36(4): 55-68.

Çetin, C. (1996). *Yeniden Yapılanma, Girişimcilik, Küçük ve Orta Boy İşletmeler ve Bunların Özendirilmesi.* İstanbul: Der Yayınları.

Demirdöğen, O ve Küçük, O. (2003*).* Kıyaslama (Benchmarking) Süreci ve Ürün Odaklı Kıyaslamanın İmalatçı İşletmelerde Uygulanmasının Verimliliğe Etkisi, *İktisadi ve İdari Bilimler Dergisi*, 17(3-4): 303-320.

Doğan, S. (2006). *Personel Güçlendirme: Rekabette Başarının Anahtarı*, (2. Baskı) İstanbul: Kare Yayınları.

Efe, M. N. (2019). Yönetim Bağlamında Kıyaslama Tekniğinin İşletmeler İçin Önemi, *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi*, 7(2): 95-99.

Efil, İ. (1999*). İşletmelerde Yönetim ve Organizasyon.* İstanbul: Alfa Basım Yayım Dağıtım.

Elçin, B.A. (2012). Küreselleşmenin Tarihçesi. Ankara. (Online) http://www.meritymm.com/wpcontent/uploads/2013/05/kuresellesme.pdf [Date of Access: 06.12.2021]

Erdağ, E. (2001). *Örgütlerde Çalışanları Güçlendirme (Empowerment) ve Bir Örgüt Ortamının Güçlendirme Açısından Değerlendirilmesi,* Unpublished Master Degree Thesis, Osmangazi Üniversitesi, Eskişehir.

Erdem, B. (2006). İşletmelerde Yeni Bir Yönetim Yaklaşımı: Kıyaslama (Benchmarking) (Yazınsal Bir İnceleme), *Balıkesir Üniversitesi Sosyal Bilimler Enstitüsü Dergisi,* 9(15): 65-94.

Ergun, E. ve Yılmaz, O. (2013). Entelektüel Sermayenin, Rekabet ve Yenilikçilik ile İlişkisine Literatür Açısından Genel Bir Bakış, *Bilgi Ekonomisi ve Yönetimi Dergisi*, 8(1): 129-134.

Haykır Hopikoğlu, E. (2011). Entelektüel Sermayenin Önemi, Sınıflandırılması ve Ölçme Yöntemleri: Kuramsal Bir Çerçeve, *İstanbul Üniversitesi Sosyal Bilimler Dergisi*, (1): 88.

İlğan A., Erdem M., Taştan M. ve Memduhoğlu, H. B. (2008). Örgütsel Gelişim Aracıları Olarak Toplam Kalite Yönetimi İle Stratejik Yönetim Ve Planlama Yaklaşımları, *Çukurova Üniversitesi Eğitim Fakültesi Dergisi,* 35(3): 72- 92.

Kanbur, A. (2008). Küreselleşme Sürecinde Post Modern Örgüt Yapıları, *Süleyman Demirel Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 13(3): 387-404.

Kara, E. ve Çavuş, F. (2014). Turizmde Modern Yönetim Uygulamaları*, Akademik Sosyal Araştırmalar Dergisi*, 2(1): 473-485.

Karaaslan, A., Demirci, M. K. ve Seçer, F. (2003). Afyon İli Jeotermal İşletmeciliğinin Şebeke Organizasyon Modeli İle Yeniden Yapılandırılması, *Afyon Kocatepe Üniversitesi İ.İ.B.F. Dergisi*, 5(2): 21-35

Karaca, G. (2007). *Küreselleşme ve Büyük Ortadoğu Projesi*, Master Degree Thesis, İnönü Üniversitesi, Malatya.

Kılınç, İ. (2006). Otel İşletmelerinde Stratejik Planlama Finansal Performans İlişkisi: Türkiye'deki 4 ve 5 Yıldızlı Otellerde Bir Alan Araştırması, *Seyahat ve Otel İşletmeciliği Dergisi,* 3(1): 34-47.

Kimberly, J. (1979). Issues in the Creation of Organizations: Initiation, Innovation, Institutionalization, *Academy of Management Journal*, 19(9): 437-457.

Koç, H. ve Topaloğlu, M. (2017). *Yönetim ve Organizasyon Kavramlar-Teoriler-Yaklaşımlar.* (3. Baskı). Ankara: Seçkin Yayınevi.

Koçel, T. (1999). *İşletme Yöneticiliği*. İstanbul: Beta Basım Yayım Dağıtım.

Koçer, S. ve Erdoğmuş, N. (2011). Türkiye'de Özel Televizyon Kuruluşlarının Örgüt Yapılarının Dönüşümü, *Eskişehir Osmangazi Üniversitesi İİBF Dergisi*, 6(2): 235-262.

Kutum, H. (2017). *Küreselleşmenin Etkileri Elektronik Ticaret ve Transfer Fiyatlandırması*, Master Degree Thesis, İstanbul Üniversitesi, İstanbul.

Republic of Turkey Ministry of Culture and Tourism, 2021. https://ankara.ktb.gov.tr/Eklenti/92612,2021-kultur-ve-turizm-verileripdf.pdf?0 [Date of Access: 12.02.2022]

McGill, M. E. and Jr Slocum, J. W. (1994). *The Smarter Organization: How to Build a Business That Learns and Adapts to Marketplace Needs,* New Directions in Business.

Memduhoğlu, H. B. (2010). *Yönetimde Yeni Yaklaşımlar*. Ankara: Pegem Akademi.

Önder, M. (1998). Örgütsel ve Yönetsel Eklektizm: Toplam Kalite Yönetimi, *Amme İdaresi Dergisi,* 31(3): 37-74.

Özgüner, M. ve Özgüner, Z. (2015). Stratejik Yönetim, Stratejik Planlama ve Toplam Kalite Yönetimi İlişkisi, Stratejik Toplam Kalite Yönetimi, *Akademik Sosyal Araştırmalar Dergisi,* 3(21): 437-449.

Saylı, H., Kurt, M. ve Baytok, A. (2006). Şebeke (Network) Organizasyon Yapılarının Rekabet Gücü Kazandırma Rolü ve Afyonkarahisar Mermer Sektöründe Bir Uygulama Örneği, *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi,* (16): 31-46.

Seymen Aytemiz, O. (1999*). İşletmelerde Yeniden Yapılanma (reengineering) Süreci ve Otel İşletmelerinde Ziyafet Organizasyonu İçin Bir Model Önerisi*, Unpublished Master Degree Thesis, Balıkesir Üniversitesi, Balıkesir.

Scott, R. (1987). The Adolescence of Institutional Theory, *Administrative Science Quarterly*, 32(4): 493-511.

Sleznick, P. (1996). Institutionalism Oldand New, *Administrative Science Quarterly*, 41 (2), 270-277.

Shy, O. ve Stenbacka, R. (2003). Strategic Outsourcing, *Journal of Economic Behavior & Organization*, (50): 203–224.

Stewart, A.T. (1997), *Entelektüel Sermaye*, (Translated: Elhüseyni, N.), İstanbul: MESS Yayınları.

Sullivan, P.H. (2000). *Value –Driven Intellectual Capital*, John Willey and Sons Press, NewYork.

Şenel, M.S. (2019). *Örgütsel Vatandaşlık Davranışının Entelektüel Sermayeye Etkisi,* Unpublished Master Degree Thesis, Afyonkarahisar Kocatepe Üniversitesi, Afyonkarahisar.

Şimşek, Ş.(2005). *Yönetim ve Organizasyon*. Konya: Günay Ofset.

Taş, Y. F. ve Aksu, A. (2011). Toplam Kalite Yönetimi ve Stratejik Liderlik, *Organizasyon ve Yönetim Bilimleri Dergisi,* 3(2): 351-361.

Taşkıran, N. (1992). Stratejik Yönetim Aracı Olarak Amaçlara Göre Yönetim, *Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 7(1): 365-382.

Tekin, Z. (2019). Entelektüel Sermayenin İşletme Verimliliği Üzerindeki Etkisi, (Ed.) Yalçın, A.: *İşletme ve Yönetim Araştırmaları II* in (pp: 429-436), Ankara: Genel Dağıtım Akademisyen Kitabevi.

Toksöz, S. (2018). *Öğrenen Örgütler ve Etkili Olduğu Örgütsel Kavramlar*. İstanbul: Artıkel Yayıncılık.

Turan, A. (2014). Temel Yetenek ve Dış Kaynaklardan Yararlanma Tekniklerine Felsefik Bir Bakış: Dinamik Beceriler ve İş Modeli Yaklaşımlarıyla İlişkilendirme, *Kafkas Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 5(7): 147–170.

Ülgen, H. (1990). *İşletmelerde Organizasyon İlkeleri ve Uygulaması*, İstanbul: Gençlik Basımevi.

Yıldız, H. ve Çobanoğlu, S. (2016). *Tracking Clues of the Management by Objectives in Today'sTurkish Public Administration Area,* Global Business Research Congress (GBRC), 26-27-May 2016, İstanbul/TURKEY.

Yüksel, A.N. (2020). Nitel Bir Araştırma Tekniği Olarak: Görüşme, *International Social Sciences Studies Journal,* 6(56): 547-552.

**APPENDIX: INTERVIEW FORM**

1. Who determines the main goals, objectives and strategies of your enterprise?

2. Which employee levels are included in the studies carried out in this direction in your organization?

3. By what methods are these plans determined?

4. What is the level of participation of your employees in the decision-making process in your company?

5. Who determines the performance and responsibilities in your enterprise?

6. Do you get help from professionals during performance appraisal?

7. Do you periodically carry out employee satisfaction studies?

8. How often and to what extent do you involve lower level managers and, if necessary, your employees in management processes and decisions?

9. Do you share your goals, objectives and practices with your lower level management and employees?

10. Do you have special values and information that give you an advantage in the sector and make you different from other businesses?

11. If your answer is yes; what features do you have that sets you apart in the industry?

12. Do you have qualifications and promotion criteria/systems (for recruitment, employment and quitting)?

13. Do you work on the commitment and satisfaction of your employees?

14. If your answer is yes; what methods do you use? Are these methods scientific? Do you get outside professional help in this regard?

15. Do you have values in intellectual property such as license, copyright, patent, design?

16. How often do you carry out your R&D studies?

17. Do you give importance to IT infrastructure? Are you making investments in this regard?

18. Are the assets of your business that are invisible and not included in the financial statements important to the business?

19. For which aspects does your business prefer outsourcing?

20. Does outsourcing affect operational efficiency and employee productivity? If so, in what ways does it affect?

21. What difficulties does your business face in outsourcing?

22. What were the effects of the long-term outsourcing on your business?

23. In which aspects do you conduct benchmarking studies in order to move your business forward?

24. Does your business conduct benchmarking studies or do you get outside help? If you are getting professional help, which company do you work with and what kind of comparison study do you conduct?

25. In which aspects does your organization have the most difficulties while carrying out internal or external benchmarking studies? And why?

26. What is the working strategy of your business in order to adapt and survive the changes in the technological, economic and social fields that occur within the business?

27. How do you define how to learn the service, creativity, systematic thinking and openness in your business?

28. What kind of activities do you carry out to increase the learning ability of your employees, including top managers in your business?

29. What is the level of participation of the employees in the solution and decision processes in your organization? Do only the relevant unit or all the members of the organization participate in the solution and decision process in the solution of a problem?

30. What is the level of sharing the knowledge, skills and experiences, managerial decisions and practices gained in the trainings held within your organization with the employees?

31. What kind of studies are carried out in your organization on the sharing of information by the management, both with all employees and among employees? (For example, separate training and ongoing meetings)

32. Before the personnel is assigned to a job within the enterprise, do you conduct a preliminary research, study and evaluation on the suitability of the task for that personnel?

33. Decisions taken within the enterprise, plans and targets for the future, with whom are they shared, to what extent are they shared, and by what method?

34. What are the methods and rules you follow in determining which personnel will be assigned which task when assigning?

35. What kind of a way is followed in your company in order to harmonize the efforts to strengthen the personnel with the organizational culture?

36. To what extent can lower, middle level managers and all your employees make independent decisions about their fields and work in your company, what are the limitations and freedoms?

37. When your employees are given similar jobs, what incentives are given to motivate them to work as a team spirit?

38. After the manager assigns and authorizes his subordinate to do a job that belongs to him, how is the responsibility distributed or to whom does it belong in case of any problem or negativity?

39. Is it possible for the employee to have experience in different positions outside the field of expertise in the enterprise? Among which departments is this practice frequently performed?

40. When you feel a lack of motivation on employees in your business, do you have methods and practices that you use to repair it? If so, what are they?

41. Are the employees in your business experts in their field? While the work and transactions are carried out by the employee, is the balance of duty, authority and responsibility determined on the basis of expertise?

42. Is there an administrative work commission/group/team or unit that examines the annual activity reports, determines the negative, deficient or faulty aspects of your organization and works to correct and improve them? If not, how do you provide such inspections and studies?

43. How is your organizational chart? In the process of assigning a job in a department, are job descriptions clearly stated to the employees by whom and where the job will be done, how it will be done, with what authority and responsibilities it will be fulfilled?

44. Is the continuity and sustainability of the business affected when the top managers or department managers are not/cannot be on duty for some reason in your organization's working system? Is there a malfunction in the operation?

45. Do you have a written document that includes the vision and mission of the business, the general and specific objectives of the business, and all the rules regarding business and operation?

46. What kind of work do you carry out to strengthen personal development, team building activities and organizational culture in order to create an effective and healthy communication system among employees, which are among the important responsibilities of the senior management?

47. What are you doing to make a difference and to be preferred in dynamic markets that appeal to global customers, according to what customers want, which are usually online today? In addition to this, what are the studies you do to keep up with the innovations and stay up to date?

48. While revealing the service you produce, do you come together with other companies specializing in different business lines? If so, which business lines do you prefer?

49. Do you make long-term cooperation with more than one company while producing services? Or are your collaborations short-lived? What are your job preferences in terms of duration?

50. Are you working within a leading company?

51. How do you purchase the materials you use while producing services? Are you purchasing through an intermediary or individually?

52. Which of the following features is most important to you while you build trust with the businesses you cooperate with? Why? (To be competent in its job, to be consistent in its behavior, to be loyal and honest with you, to be open to sharing its knowledge and information? )

53. Does your business organize quality training programs for employees in the quality improvement process?

54. What do you think about long-term employment?

55. Do you have a pre-prepared plan, program and work team to implement it for possible negative situations?

56. What methods are used to evaluate the quality of goods and services in your hotel? Are these methods scientific methods? Do you receive professional service in this regard?

57. Do you use quality groups, quality improvement groups, quality circles in your planning and operational studies? Do you have quality certificates? (If yes, which certificates do you have?)

58. How often do you carry out studies to identify and evaluate the strengths and weaknesses of your business? (If yes, how are the results interpreted and implemented?)

59. Would you like to change the rules and institutional structure in your business, and in addition to this, change the understanding, thinking and behavior patterns? (If yes, why and with what methods do you perform it and do you use scientific methods?)

60. Which value-added activity do you adopt as a priority when you decide to restructure your business? (For example, reducing costs, seeking opportunities to find new resources, gaining competitive advantage in the market, etc.)

61. In times of crisis that may be experienced throughout the country or the world, businesses may go through some changes in order to be affected by the negative results at the lowest level. In this context, what kind of change strategies have you implemented within the scope of your business in the Covid-19 pandemic crisis?